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The Cement Industry of Cuba

International Cement Corporation Has Modern Cement Plant in a Land of Enchantment

THE FOLLOWING DESCRIPTION of the plant of the Cuban Portland Cement Co. was based on a visit when the plant was working at its full capacity. The normal consumption of cement by the Island of Cuba is only about a million barrels per year, but when the Cuban government a few years ago embarked on a large plan of public improvements, including the famous central highway, the Cuban Portland Cement Co. arranged to meet the increased demand by the installation of three kilns and the necessary equipment to enable them to produce more than 2,000,000 bbl. of cement per year.

While this work was in progress the plant was humming day and night, labor was fully occupied at high wages, and a general air of prosperity was present everywhere. With

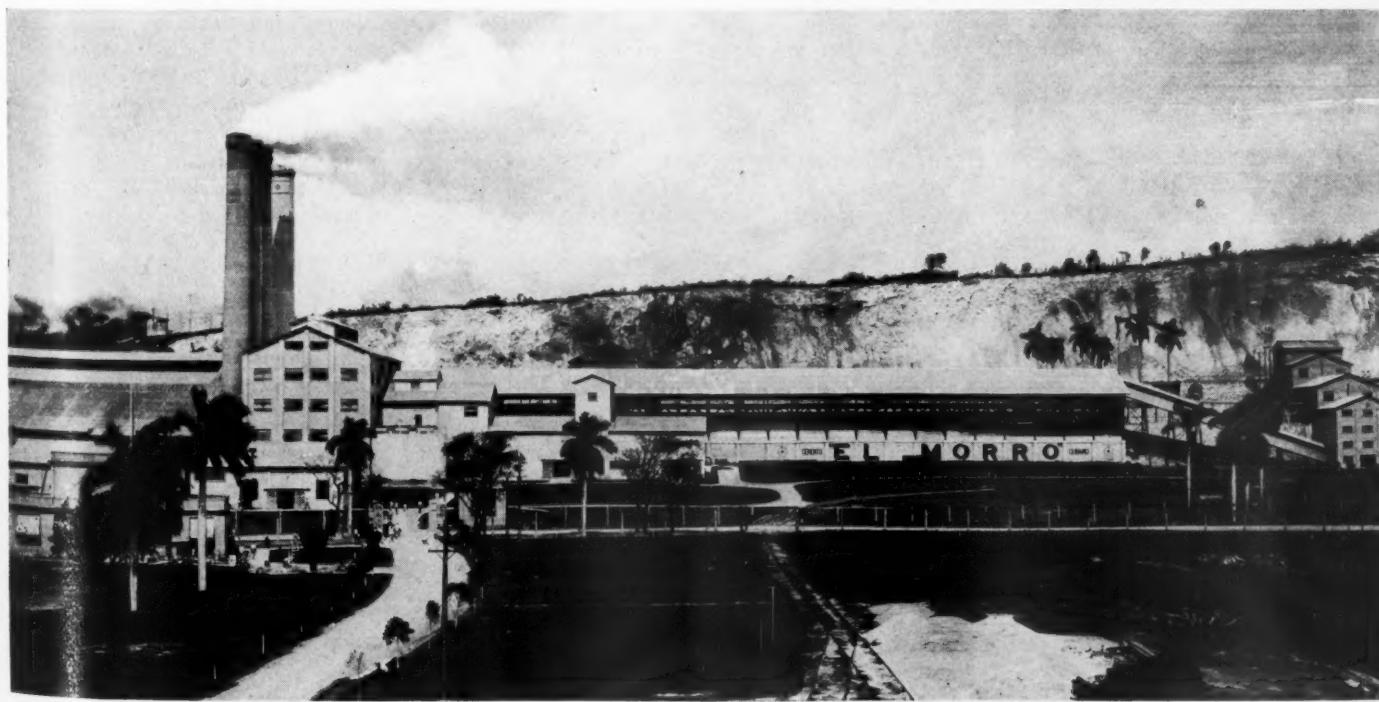
the completion of the central highway at the end of 1930, the public works program was practically terminated and the general world depression has also affected Cuba, with the result that at the present time all activities are very much reduced.

Cement consumption is less than 40,000 bbl. per month, so that the capacity of the plant is greatly in excess of demands unless some large public works program should again be undertaken. The management of the parent company therefore arranged to relieve the Cuban company of some of its capital investment, and the surplus equipment is now being dismantled and shipped to a new plant being built by the International Cement Corp. in Brazil.

The plant is working now on a two kiln

basis and on part time and the large, previous organization has been partly disbanded. The company is making every effort to keep its labor employed and the dismantling work at present is relieving the situation to some extent. The company is also constructing a concrete road from Mariel out to the plant on which a large number of laborers are kept busy. This will provide a modern concrete driveway out to the plant instead of the primitive dirt road that existed before.

The dismantling of the equipment referred to will not change the general aspect of the plant. Everything is being put in order so that the plant will appear again as it had been before the public works program started. It will be a four kiln plant with more capacity than can reasonably be con-



General view of plant with quarry layout



Time keeper's office at left, general plant office at right

sumed on the Island of Cuba for some years to come.

Plant Surroundings

If one can picture a beautiful park with an imposing array of tropical plants along the shore line of a southern sea, with a back-

imagine a large industrial plant dimly outlined through the tropical forests—not as a blot to mar the beauty of the picture but more as a monument to industrial civilization—then one will begin to have a mind picture of the setting and surroundings of this most

monotonous buildings of the same general design. The only redeeming feature is the small park with its bandstand of reinforced concrete and concrete settees inlaid with multi-colored stone. Many of the Cuban plant employees live here, while some of them live in homes along the road between the plant and Mariel, or at the little village of Mojica just beyond the cement plant.

Leaving Mariel for the cement operation, one passes first through the beautiful little town of Cayo Mason, a town made up entirely of homes of the staff. Here a store, post office, telegraph office and ice plant are operated by the company for the benefit of the employees.

The first two buildings to the right as one enters the town of Cayo Mason are the staff quarters, kitchen, dining room and home of the "Klinker Club." The larger building is devoted to the operating staff and the other is used as a guest house for visitors and for the visiting executive officers from Havana and New York City.

The interiors of these buildings, as well as the homes in Cayo Mason, are in keeping with the exteriors, the floors and wainscoting being of Spanish tile, softly colored, and blending perfectly with the tinted ceilings. The screened-in porches overlooking the bay enable one to sit and gaze in admiration at this artistic cement park.

The homes furnished the various depart-

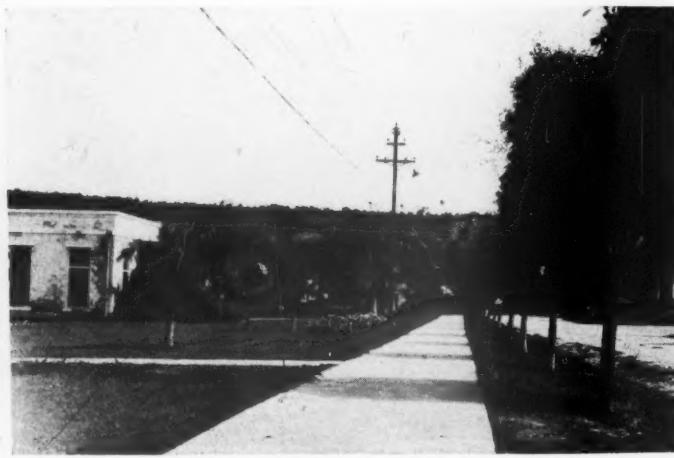


Another view of the plant

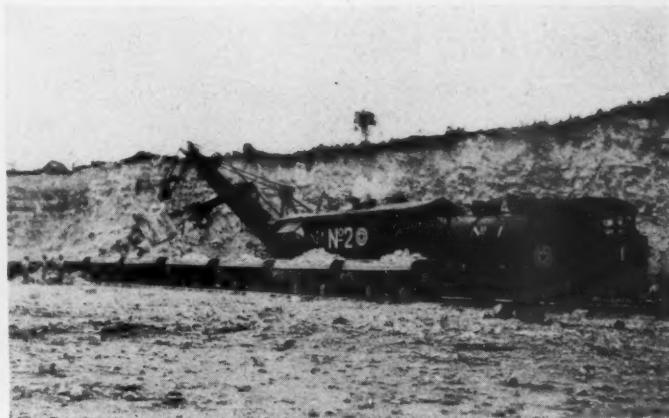
ground of rugged hills clothed in a tangle of tropical brambles and stately royal palms; if one can also picture a group of pretty, homey bungalows overlooking the ocean, with broad lawns, bordered with ever-blooming flowers, garden plots enclosed in coral; if one will vision all this and then

beautiful and picturesque cement plant, that of the Cuban Portland Cement Co. at Mariel, near Havana, Cuba.

The plant is located about two miles west of Mariel, a typical inland Cuban town of perhaps 3000 population, a town devoid of beautiful homes or estates, with rows of



Two street scenes in the town of Cayo Mason



At left, electric shovel used for loading clay; at right, train being loaded with rock

ment heads are all pretty and modern, with all conveniences and surrounded by beautiful lawns. As the shadows lengthen in the

bay below, or further to the west across the broad expanse of Mariel Bay the lights beyond. It is no wonder that visitors are

generally covered with coral of odd and peculiar designs. The more venturesome may swim in the open bay or the more timid in a protected pool along the shore. A tour of the harbor and bay of Mariel may be made past boats being loaded with crude asphalt from the interior by primitive and laborious methods; past the steam yacht *Hoyt* of the president of Cuba, anchored midstream; up an arm of the Mesquite river searching for oysters that cling to the branches of overhanging trees where the native yacht captain and his assistant gather and open the oysters; back by way of an old pirate stronghold with remnants of its walled forts and gun mountings still standing; on, and too close for comfort, past the leper colony; across to the monument and old cannons placed on the spot where an early Cuban patriot landed with his army; past a barge-load of cement en route to Havana, pulled by puffing tugs; and then returning to Cayo Mason, one can see on top of a steep and rugged mountain the single stone building of Cuba's naval academy outlined against a background of dark and forbidding clouds; and land at the dock below the club house, where dinner is served. If one is lucky enough to be there when a royal palm has toppled into the quarry incidental to the advancement of the quarry face, that extremely rare (and forbidden) and delicious edible "heart-of-the-palm" will be found served

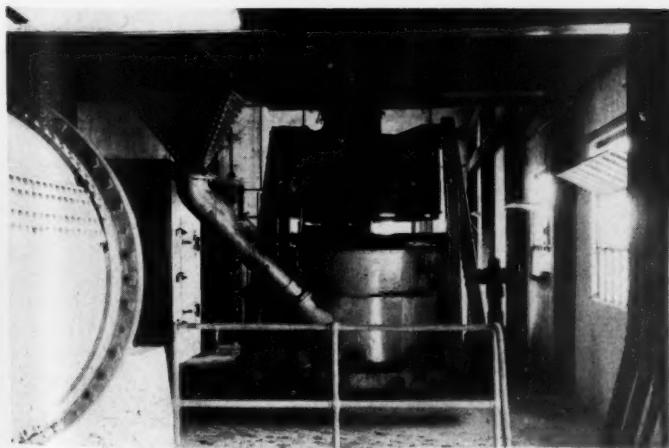


Quarry cars at the primary crusher

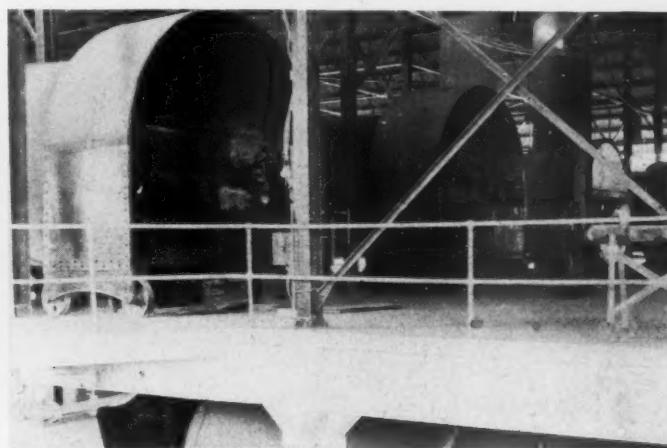
evening, one may sit amid comfortable surroundings on these porches and see the twinkle of myriads of lights from the plant and quarry reflected in the waters of the

conducted to this plant, as it is one of the show places of the Island.

The early rising guest may, if he wishes, go in for a morning swim on a beach lit-



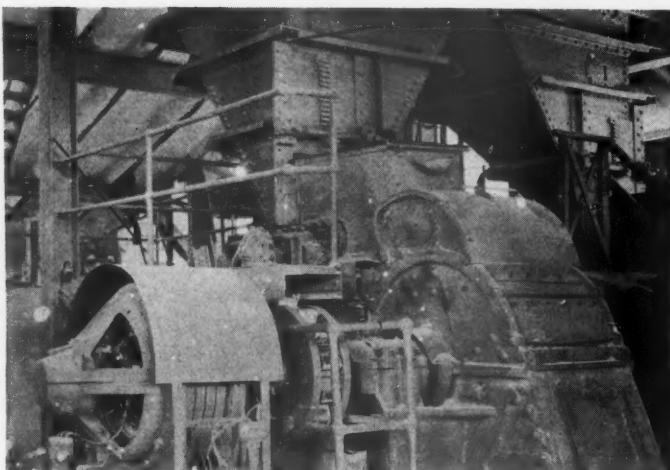
Showing the raw mills



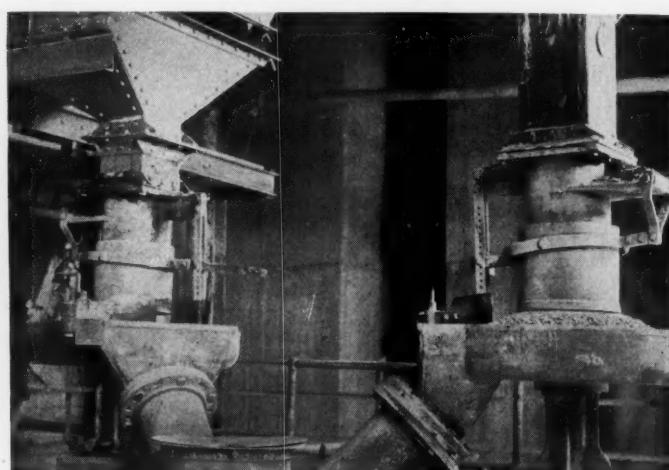
Firing end of kilns with coolers below



Limestone and clay storage building



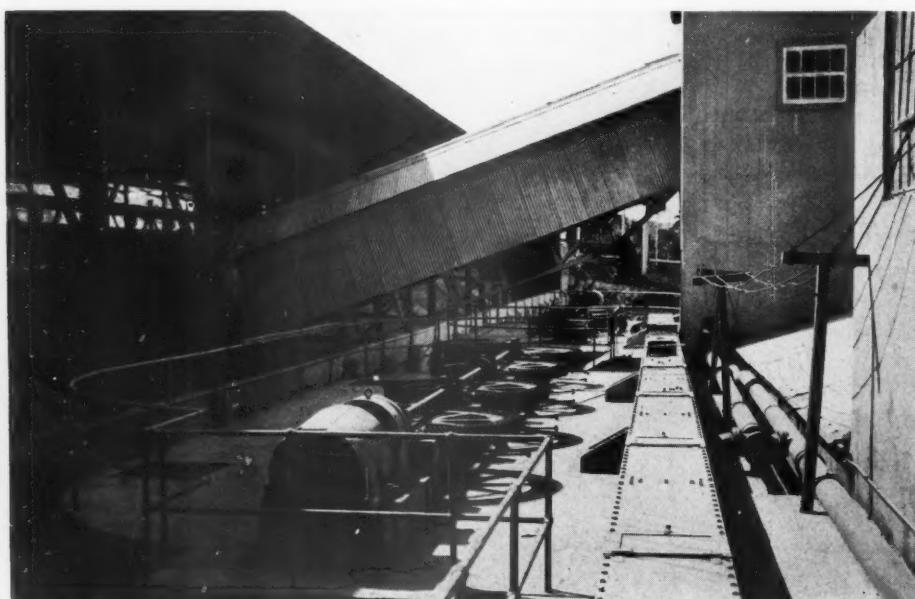
Hammer mills in raw end



Clinker and gypsum feeders

both cooked and raw, and the day winds up with unforbidden drinks of Cuba's favorite

cocktail, "El Presidente," or wine if desired. What a life for a cement operator to live!



Looking along the slurry correction and storage tanks

Days could well be spent visiting the tobacco plantations, banana, pineapple and mango groves, where rare and unpronounceable tropical fruits are grown; the Cuban native homes with their thatched roofs; the school at Mojica for Cuban children of the employes and another school at Cayo Mason for the children of the staff; poking around here and there, every minute of the time showing something of unusual interest.

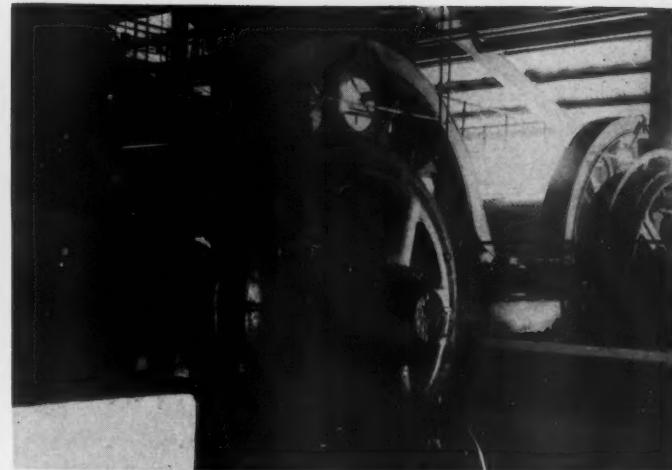
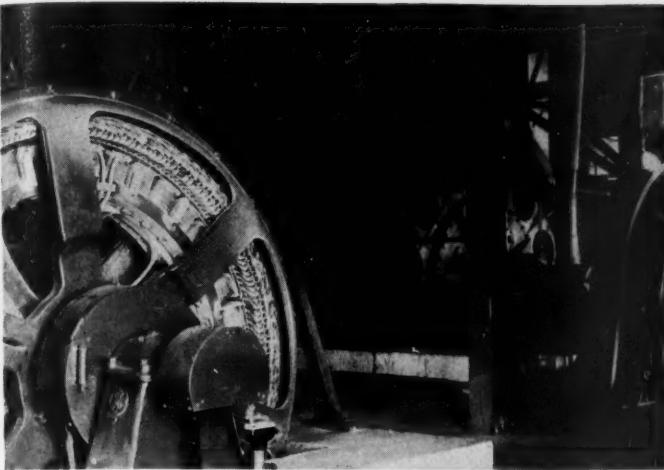
All social activities are by no means confined to the staff and their guests, for frequently barbecues and field days are held in honor of some department's non-accident record. The Cuban laborers in the various departments vie with one another to win and hold the silver safety trophy presented by the executive officers. At these field days there are sports of all kinds, usually for small prizes, with band concerts and speeches and the outdoor banquet.

The weather is not always typical of a late spring day, for sometimes hurricanes

strike with extreme violence, as did the one in Havana in 1925, causing millions of dollars in damage and a terrible loss of life. To protect the employes and others from such a storm as this, a large monolithic reinforced concrete building with thick walls and roof has been built as a haven of refuge.

Although virtually a fortification against the elements, its interior and exterior were designed with that same artistic good taste so evident on every side. It resembles an ordinary hall rather than a cellar and is used as a motion picture theater, dance hall and recreation center. The long benches are so designed that they can readily be converted into comfortable beds, and stocks of provisions, water and kitchen utensils are provided for emergency.

The plant itself is less than a quarter of a mile from the staff house and sets on slightly sloping ground about midway between the quarry and waterfront. All of the space not occupied by the plant or the winding concrete roadways is a blue grass lawn dotted with royal palms and with rows of small trees bordering the driveways. The



Compeb mills and drives on finish and raw ends

highway divides this area, the plant being on one side and the office and dockage facilities on the other.

Entrance to the plant is through a gate flanked by massive concrete pillars and guarded by a timekeeper's office of unusual architectural beauty. Across from the timekeeper's office is the main operating office, another massive and well designed building of reinforced concrete. The ground floor contains the offices of the superintendent, plant engineer and the chemical and physical laboratories. In the laboratories are found all the usual chemical and physical testing apparatus and in addition a dark room is provided for developing and printing pictures. This method of sending engineering information to the New York office is very popular, as shown by the thousands of pictures on file, neatly cataloged and filed, showing all phases of the company's operations. Upstairs is the office of the clerical and auditing department.

Construction of Present Plant

Early attempts to manufacture portland cement on the island of Cuba were made by a French company, starting in 1898. That plant was built on the outskirts of Havana proper, but was unable to compete successfully with the better quality cement imported

from the United States and was abandoned about 1921.

Construction of the present plant at Mariel was started in 1916, during the war period,

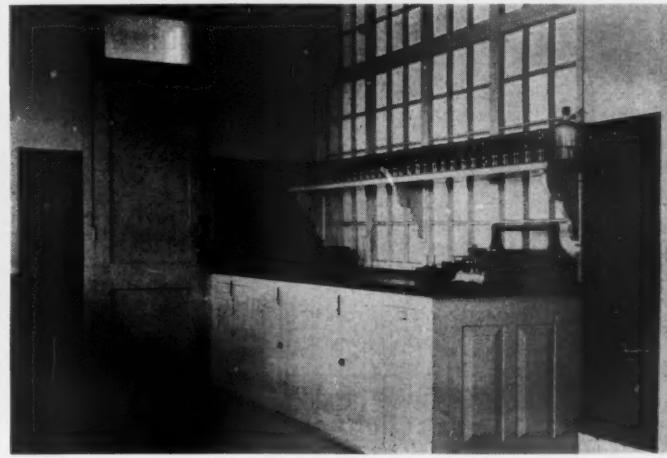
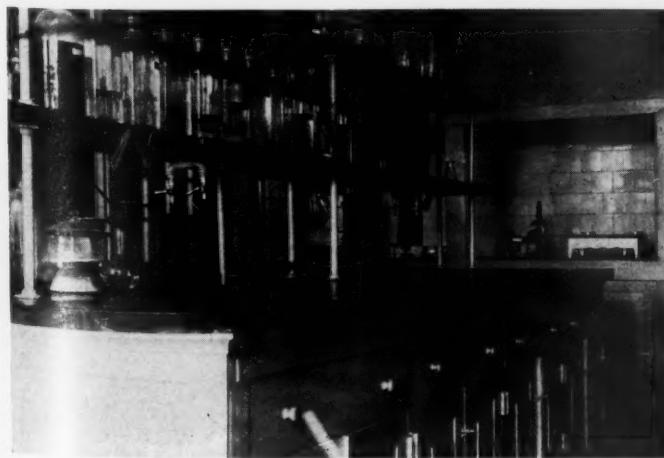
first shipments of cement from the plant were not made until December, 1918. The difficulty of purchasing standard cement equipment accounts, in a measure, for the



Dock where bulk cement is loaded out

but because of the difficulty of getting ships on which to load the equipment, to say nothing of the troubles encountered in trying to purchase machinery during that period, the

type of machines used. Also the plant was originally built to use the dry process and was later changed to the wet process, so that it is not as symmetrical as some, but it is



Two views in the chemical and physical laboratory



One of the self unloading barges in which bulk cement is transported to Havana

without doubt neater and cleaner than some of the so-called modern plants.

Quarry Operations

Cement is made here from two materials, limestone and clay. The limestone, which is locally referred to as "coco rock," is a soft white to gray colored high calcium stone. The quarry face is about 4000 ft. long and varies from 40 to 65 ft. in height. Not all of this length is "coco rock," as here and there are areas of a hard cherty limestone. At first these lenses of stone were left standing, giving the quarry an uneven appearance, but as much of this material as possible is now being used in order to keep the face straight.

The clay is secured at the southerly end of the same quarry face, and to a casual observer would seem to be very little different than the "coco rock." This material is loaded by a 1½-yd. full revolving electric shovel to side dump cars, which are hauled to the crushing plant by one of three 45-ton standard gage, saddle-back steam locomotives. No shooting is necessary for the clay, but the "coco rock" has to be blasted. An electric churn drill is used, drilling holes 25 ft. apart and 20 ft. back from the face. These are loaded with 40% dynamite. Some primary drilling is also done with jackhammers in the softer portions of the "coco rock," as heavy shooting is unnecessary with this material.

The limestone is loaded by two 2-yd. railroad type steam shovels to side dump steel cars for haulage to the crushing plant. No overburden is removed from either the "coco rock" or the clay, but the heavy growth of vegetation must be removed on the drilling bench.

The clay cars are dumped by an electric hoist to a long concrete chute from which the material is fed by a pan conveyor to a hammer mill. This mill discharges to a 30-in. belt conveyor which carries over to an open storage at the west end of the limestone-clay ground storage building.

The stone cars are dumped at the crush-

ing plant by an electric hoist and the rock falls to a 36-in. gyratory crusher which is equipped with a corrugated head. From the crusher the rock falls to a short inclined belt conveyor delivering to a stone box where the stream divides, falling to two steel hoppers. These hoppers are served by individual pan conveyors which feed two hammer mills. The hammer mills discharge to individual bucket elevators enclosed in concrete housings (as are all the other elevators in the plant) and discharge to a 36-in. belt conveyor extending alongside the limestone storage pile. This belt is unloaded by a movable tripper and the material cast back to the pile by a 10-ton electric crane.

The same crane delivers the clay and limestone in approximately correct proportions to a reclaiming point where belts deliver it to elevators and conveyors serving three steel hoppers. From these tanks it passes to pug mills, where water is added and the whole mass partially disintegrated. From the pug mills the product passes to three Hercules mills and then by conveyors and elevators to three two-compartment compeb mills.

The compeb mills discharge to a series of screw conveyors and bucket elevators delivering the finished raw slurry to one of four temporary storage tanks where the slurry is sampled by an ingenious sampler as it flows to its proper storage tank. From the results of these samples of four different tanks the laboratory gives instructions as to how many feet and inches of the content of the different tanks should be blended to meet the requirements established by the chemists. Variable amounts from any two, three or four tanks are drawn out and passed to a series of mixing tanks, where, if necessary, additional slurries can be added to act as a corrective, after which the slurry is pumped to storage tanks.

The correction tanks, mixing tanks and storage tanks hold approximately 2000, 3300 and 2800 bbl. of cement respectively, based on a slurry content of 37% water. Incidentally, the limestone storage holds 11,500 tons and the clay storage 3100 tons when both piles are trimmed.

From the storage tanks the slurry is pumped to a feeder tank mounted above and at right angles to the kilns. This tank is kept at constant level and each kiln receives its feed from an individual bucket feeder serving each of the four 175-ft. rotary kilns. The kilns are oil-fired, fuel coming by boat from Tampico or South American points and being stored in two steel tanks of about 138,000 bbl. capacity. The kilns are all equipped with waste heat boilers which generate sufficient power to run the entire plant and to supply power for the town of Cayo Mason.

The hot clinker falls to four rotary coolers from which it is carried by a "skipulter" to a series of bucket elevators, screw conveyors and belt conveyors and to either the silo storage bins, ground storage or to the bins feeding the three Hercules mills. The clinker in the silos is reclaimed by belt conveyors and belt feeders, while that from the outside



Cement silos and packing plant at Havana

ground storage is reclaimed by a drag scraper which delivers to the silo unloading conveyor system. These mills discharge to other conveyors and to three tube mills for final grinding, after which the finished cement is delivered by a screw conveyor to concrete silos holding 100,000 bbl. of cement. The dust incidental to the operations at the finishing end is all collected.

Gypsum

Ground gypsum is purchased from the Fabrica de Yeso Yumuri, Matanzas, Cuba, operating a deposit in the province of Matanzas, and which was described in the March 30, 1929, issue of *ROCK PRODUCTS*. The gypsum is delivered in standard gage cars at Havana by the Hershey electric railroad, where it is loaded into company barges and towed to the plant. There it is unloaded to ground storage by a clamshell bucket and delivered to the plant in trucks as needed. The trucks dump to a hopper served by a bucket elevator, from which it is chuted to small bins alongside the clinker bins over the Hercules mills. The proper proportions of clinker and gypsum are fed to these mills by a compound disc serving each mill.

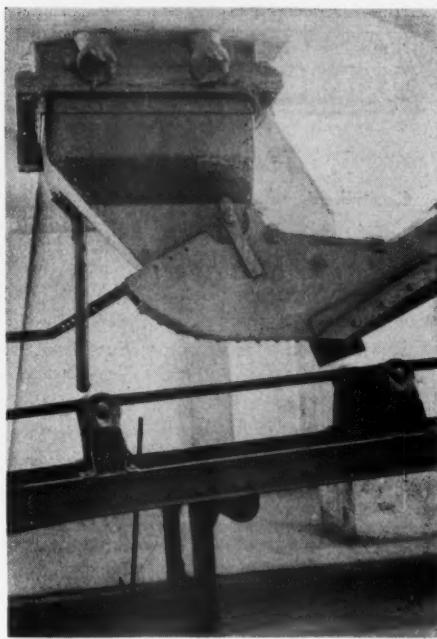
Silos

There are four silos, two by two, with one star and two interstitial bins, all the silos being 80 ft. high. For the convenience of the operator in charge of filling these tall silos an automatic passenger elevator has been provided. In addition to the silo storage there is a large rectangular shed storage available, the contents of which are reclaimed by a dragline and a screw conveyor.

The silos are emptied by a series of screw conveyors which deliver the cement to a 24-in. belt passing through a tunnel under the road separating the main plant from the loading dock. This belt discharges to a second inclined belt which delivers the product to a small rotary screen for removing any foreign material or lumps. The screened cement is then conveyed to two four-tube Bates packers, or spouted direct to the company's self-unloading barges for delivery at Havana or Neuvitas.

The barges *Mariel* and *Morro* of the Cuban Portland Cement Co. carry 5000 bbl. of cement each and are towed to Havana, where they are unloaded by Fuller-Kinyon pumps. This packing plant has silos of 31,000 bbl. capacity and two Bates packers so arranged that the sacked material can be loaded direct to trucks for transportation to points close to Havana or to standard-gage cars for more distant shipments.

A second packing plant has been built at Nuevitas, about 300 miles southeast of Havana on the north coast. This plant has a storage capacity of 100,000 bbl. and the cement is shipped to it from the plant in a self-unloading Diesel engine powered boat, the *H. Struckmann*. This boat is also equipped with Fuller-Kinyon pumps for unloading. The plant at Nuevitas serves the entire eastern end of the island.



Spout and conveyor for reclaiming clinker from storage silos

Power Plant

Steam from the waste heat boilers is delivered to three turbines, one rated at 3500 kw. and the other two at 1000 kw. These are direct-connected to alternating current generators. The power plant also includes five motor generator sets for supplying direct current to the variable speed motors used in connection with the calcining operations. A 20-ton, hand-operated, crane spans the turbine and generator room for handling the massive parts when repairs are necessary. A nine-panel switchboard with the usual meters controls the energy supplied the various units in the plant, and in addition a second switchboard of 14 panels is located at one end of the machine shop.

Water and Compressed Air

Water for plant and domestic use is se-

cured from the Mesquite river and pumped through three or four miles of 4-in. cast iron pipe to an open tank located on the bluff overlooking the quarry, from which point the water flows by gravity.

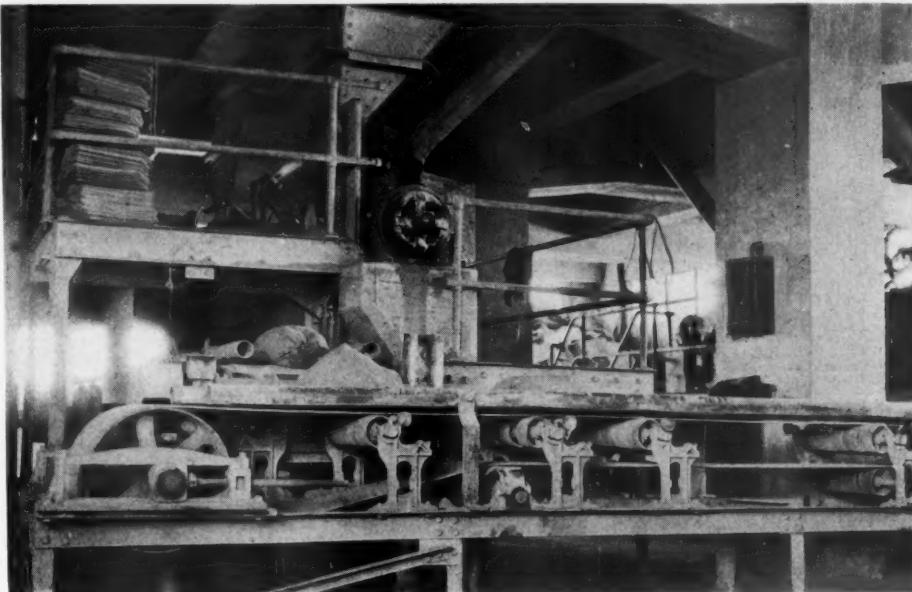
At the Mesquite river a pit was excavated a short distance back from the water's edge and lined with reinforced concrete with walls extending high enough to prevent flood waters entering and interfering with the operation. In the pit are two centrifugal pumps, each driven by a 40-hp. motor.

This pumping station is connected by a primitive suspension bridge across the river at that point.

The substation adjoining the shop contains four compressors; one of which supplies air at 30 lb. from the low pressure cylinder and 90 lb. from the high pressure side, and another of which supplies low pressure air for slurry agitation.

Personnel

The Cuban Portland Cement Co. is one of the 16 operations of the International Cement Corp., with offices at 342 Madison Ave., New York City. This subsidiary company has executive offices at 334 Manzana de Gomez, Havana. The executive officers are: H. Struckmann, chairman of the board, New York City; J. E. Cartaya, president, Havana; L. S. Thompson, vice-president and general manager, Havana; A. K. Hallett, treasurer and assistant secretary, Havana; H. H. Muehlke, secretary, New York. The board of directors of the Cuban Portland Cement Co. are: H. Struckmann, chairman; F. R. Bissell, J. E. Cartaya, Charles Hayden, R. F. Hoyt, Robert G. Stone, H. H. Muehlke, R. W. Atkins and Charles L. Hogan. In the Havana office, Jose M. Reyes is auditor; Louis Garcia, purchasing agent; Miguel Kohly, sales manager; M. Aragon and M. Villa, promotional engineers; and W. Detwiler, assistant to the manager. John Rae is superintendent at Cayo Mason.



Interior of pack house at Havana

The Making of Stone Sand

By Edmund Shaw
Contributing Editor, Rock Products

STONE SAND or crusher sand is made in two ways: by washing the screenings from coarse crushing and grading them so that they are suitable for concrete fine aggregate, and by crushing larger pieces to sand size. The first method is used where the plant produces more fines than the ordinary market will absorb. It has been very successfully applied in some large operations in Ohio. The second method is used where the deposits of good natural sand are not sufficient to supply the local market. Attempts have been made to apply it in several parts of the country but such attempts have not been so successful as to make it a common practice, although the writer believes it could be done more successfully if the right machines and methods were used.

Natural sand has usually rather roundish grains and being water deposited there is usually a fairly continuous grading from fine to coarse throughout the deposit. Generally speaking, natural sands run too much to fines (although there are some exceptions to this), and they need no further preparation than washing in some device that will act as a classifier and throw out the excess of fine sand along with the dirt. The rounded shape tends to promote workability even where the grading is not the best.

Nature of Stone Screenings

Stone when it is crushed breaks into angular pieces, as most rocks crushed commercially have a conchoidal fracture. The ordinary machines used for crushing also tend to break off splinters and thin slabs which go into the fines. This gives mortar made from stone screenings a harsh texture which makes both mortars and concrete difficult to finish. The strength of mortars and concretes made with screenings is usually, but not always, satisfactory. In fact, it often happens that the mortar and concrete strengths are higher than those of concretes made with the local sands with which the screenings come in competition. Still the contractors and engineers prefer the natural sands because of the greater workability and better finishing quality that they impart to the concrete. There are occasional localities in which the reverse is true, as in one Texas city where stone screenings are much preferred to the natural sand of the locality, but the rule is the other way.

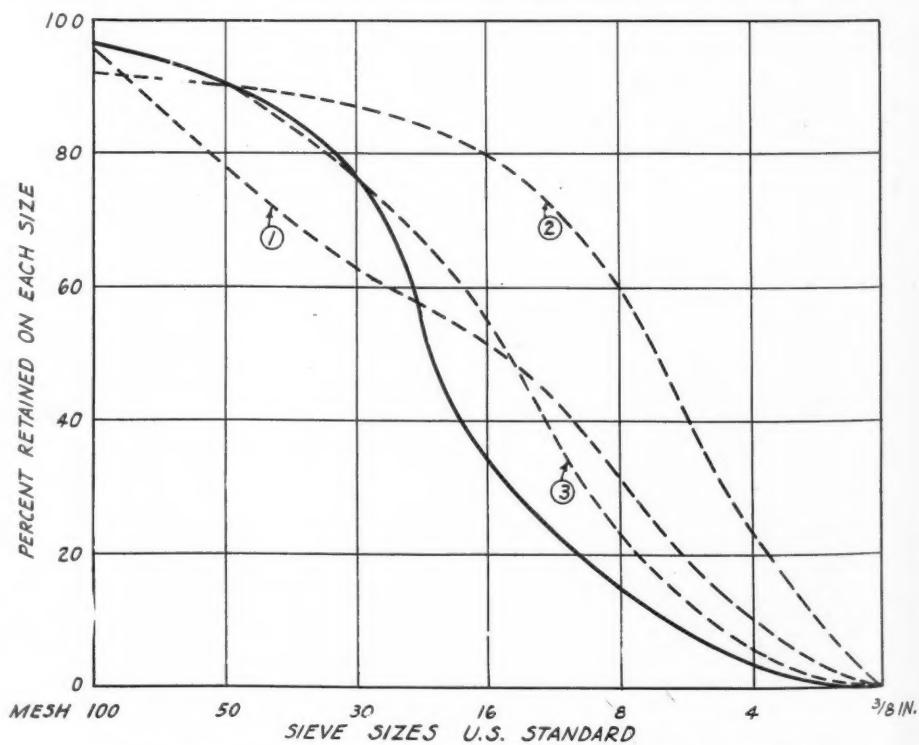
Hence to bring stone screenings to where they will compete with natural sand it is necessary to improve them so that they will make more workable mortars. One

method tried in the past was to run in as much stone dust as possible which would muffle the effect of the angular pieces. In making concrete products stone dust is often added to promote workability and make the product less porous, but it is not a method that can be easily used with mass concrete. Abrams says that dust up to 10% does no harm so long as the concrete is thoroughly mixed and of a proper consistency. But dry dust has a way of floating on the water, of "balling up" and making other troubles for the mixer man. Now most specifications limit the amount that aggregates can carry. The present tendency is to wash out all of the dust and silt from both coarse and fine aggregate, so that improving workability by adding dust may be considered as "out."

A second method is to add sand, especially sand of a size that will improve the grading. That may be done successfully to a limited extent and some state highway specifications permit as much as 50% of stone screenings to be added to natural sand. Anderegg in a recent paper says it will be found economical to add crushed stone fines to sand that is deficient in the coarser sieve sizes, and of course the rule will work both ways so that it will be equally good practice to add sand to coarse and harsh screenings.

However, this does not seem to have been a very satisfactory solution of the problem. The contractor does not want to buy sand and screenings separately and combine them at the mixer. Attempts to market the mixed fine aggregates have not been so successful because purchasers complain that they are not well mixed in the beginning and that they tend to segregate. Thorough mixing is more of a problem than it seems to be from mixing laboratory samples when one is handling large quantities. If the screenings have to be washed, as most fine aggregates have to be to remove dust and clay, it would appeal to be sound practice to mix the fine sand and screenings before washing, using some elevating or feeding devices that would feed both sand and screenings uniformly and a type of washer (drag or screw) that would give them some agitation.

The third method of improving workability is to improve the grading of the screenings. Workability of concrete, according to a recent paper by F. O. Anderegg, is dependent on the water used and the grading of the aggregate, especially of the fine aggregate. His work shows that the nearer the grading approaches to a smooth continuous curve of definite shape the better the workability. So if the grading of the screenings can be brought to plot as a



Grading curves of three stone screenings and one stone sand

smooth continuous curve, approaching some ideal curve, it may be expected that the workability will be brought up proportionately.

Example of Natural Grading and How to Improve It

The accompanying graph shows three curves of stone screenings (in dotted lines) and one of a stone sand made from screenings (in full line). Curves No. 1 and No. 3 originally contained 33% and 18% more minus 100 mesh material than the curves show but all but 5% was dropped in plotting to simulate the effect of washing or screening out. No. 2 curve represents the screenings as they came from the plant. These and a number of other sieve analyses of screenings may be found in H. F. Gonneman's paper on fine aggregates, A. S. T. M. Proceedings for 1929. The stone sand curve is from a private communication to the writer.

In passing it may be mentioned that the minus 100 mesh material may be successfully removed from stone screenings by air separation, if the screenings are dry or contain only a small percentage of moisture. This is now being done successfully in at least two installations of a new type of air separator. The writer hopes shortly to receive permission to describe them in ROCK PRODUCTS.

Improvement in gradation may be made by either addition or subtraction. In the case of the stone sand shown, stone of an intermediate sand size was added to the plant screenings as they were washed. The grading it will be noticed does not conform to any well known ideal curve but it is a grading that makes a good workable fine aggregate. We do not know yet that the ideal grading for an angular material like stone screenings is the same as the ideal curve for a natural sand. One would rather suppose that it would not be the same. But in any particular case the workability would have to be found by experimenting with different gradings.

The addition of sand or fine crushed rock is one method, the subtraction of a part of the screenings is another. To see how it would work let us consider curve No. 1 in the graph. This has a distressing hump between the 8 and the 30-mesh sieves. It has also too high a fineness modulus for most purposes (3.55). By splitting on 8-mesh and, say, 20-mesh screens and throwing away part of the intermediate product the hump would be removed and the proportions of fine and coarse would be improved.

This is the method which is used to improve the grading of natural sand except that classifiers instead of screens are used to make the separations. It is very successful and has been installed in one of the largest plants in the country. Classifiers may be used with screenings, too, but they should be of a type that does not require

the settlement of a considerable quantity of material, which might cause trouble by "setting." They should be of the type that uses a rising current of water to make the separation and preferably of the hindered settling type. The writer's pamphlet, "Sand Settling and Sand Settling Devices," describes a number of types of classifiers which may be used for classifying screenings and most readers of ROCK PRODUCTS have it or can get it easily.

But after a part of the screenings has been removed the question of what to do with it arises. With natural sands a market can usually be found for it because the market for natural sands is very broad. With screenings it might be more difficult. If it could be crushed cheaply and added to the product the grading in some cases

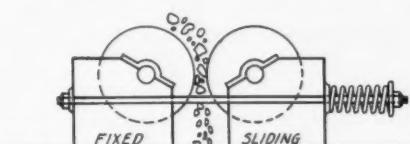


Diagram of crushing rolls

would be improved and this would be an excellent solution of the problem if it were not too expensive.

This brings us to the third method of improving grading, that of crushing. Take such screenings as are represented by curve No. 2 in the graph. This product has a fineness modulus of 4.31 which is too high for concrete fine aggregate. A little crushing would not only lower the fineness modulus but it would probably give the curve a better shape, indicating better workability.

Use of Rolls for Fine Crushing

This raises the question of the machine to use for crushing. In the rock products industry there is very little crushing to sand size, most finished products being either fine, like cement and ground limestone, or coarse, like concrete coarse aggregate. Natural sand deposits are so abundant and widespread that this material practically has this field to itself. Hence the crushing machine, rolls, which has the greatest efficiency in making sand size product is very little used in the industry.

The field of roll crushing, according to most authorities is on 1½-in. feed and under making products down to 0.1-in. This does not mean that one set of rolls can be fed 1½-in. material to make 0.1-in. product. The reduction ratio of rolls is low, not much more than a 2 to 1 reduction for really efficient work. This, however, is theoretical, for actually rolls are used for crushing ratios of 3 to 1 or even more. Gyratory crushers, cone crushers and hammer mills all have much greater reduction ratios. But none of these are as good as rolls for the purpose mentioned here because all of them make more dust and fines.

It is easy to see why rolls make less fines

than other crushers if one looks at the illustration. As the rolls are set in it, only the larger pieces will be crushed while the smaller ones pass through unbroken. Even where the rolls are set close the same thing is true. The rolls are held together by heavy spiral springs and tension rods but as soon as they begin to crush, if the springs are not set too tight, the large pieces open the rolls enough for the smaller pieces to go through.

Another reason why rolls make little fines is that they crush without torsion or differential motion if they are properly fed. If a particle is caught between a stationary and a moving surface as in a single roll, the effect is to tear it in pieces rather than to crush it. The same effect may be had with differential rolls, one roll running faster than the other. This is the way rolls for crushing wheat in flour mills are run. With soft materials this gives rapid crushing and plenty of fines. Improper feeding will also give a differential motion and make plenty of fines. But with proper feeding and attention rolls make less unwanted fines than any machine so far devised. For recrushing screenings they would seem to be the nearly ideal machine. For crushing from coarser sizes down to sand size they would have to be run in series or preceded by some crusher that had a greater reduction ratio, a cone crusher, disk crusher or other form of reduction crusher. The writer thinks that the second would be the better method.

Rolls have a further advantage in that the product is low in splintery and slabby pieces. Straight pressure crushing does not crack the particles so much and does not tear off thin pieces as torsional crushing does.

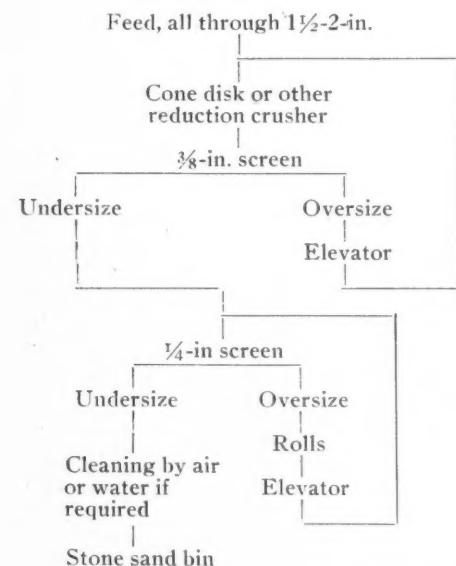
The cost of crushing in rolls is given by different authorities at from 4c. to 7c. per ton of product. With present day prices and wages probably 5c. would be more nearly correct than 7c. The capacity, according to a table in Taggart's "Handbook," runs from 0.16 to 0.20 ton per horsepower hour to 3.78 tons per horsepower hour. This looks small compared with gyratory crushers which crush from 1.5 to 15 tons per horsepower hour, and even more, but the large tonnages are made on run of quarry rock when a part goes through without crushing. With rolls the low capacities are made where the rolls are crushing very fine, say to 20-mesh, and where the reduction ratio is too high to be economical. The high capacities are made where the reduction ratio is around 2 and the product will all pass ¼-in.

Taking everything into consideration, it would be the writer's guess that with moderate sized rolls, say 36x36-in. taking 20-25 hp., the capacity would be from 2 to 2.5 tons per hour on ordinary limestone. With harder rocks it would be considerably less, unless, as is the case with some granites, the rock fractured easily along the faces of the crystals. This is a guess because it

is not based on experience. However, the writer has had experience in crushing soft and hard *ores* in rolls and has found that the capacity is much greater with soft ores, also that the trouble is proportionately less.

Capacity also varies with the size of rolls. The big copper companies use enormous rolls, some of them 72-in. in diameter. The inertia of these heavy rolls keeps them from spreading when an extra hard or extra large piece comes along and the crushing is steady and uniform. But such large machines would hardly be needed to make stone sand in a rock products plant.

Having given the advantage of rolls for crushing to sand size it is only fair to add that rolls need more care and attention than most crushers. The writer has had charge of three plants that used rolls for crushing and has been employed in others. It is his experience that rolls are only as good as the man that runs them. The feed must be evenly spread across the rolls or the shells will corrugate, and the edges must be looked after to keep flanges from forming. The feed must be kept at the point where the rolls have all they can handle but it must not exceed this or the rolls will choke. (Deliberate choke feeding used to be practised where it was desired to crush fine but for this work other machines are now considered better than rolls.) The set of the rolls must be watched and the rolls set up as the shells wear. A good man will wear roll shells to almost paper thin-



Flow sheet for hard rock and where the product must all pass 1/4-in.

ness without having to grind out corrugations or spend much time cutting or burning off flanges, but only care and attention will do this. Once the shells begin to corrugate it is a hard matter to make them true, if it can be done at all.

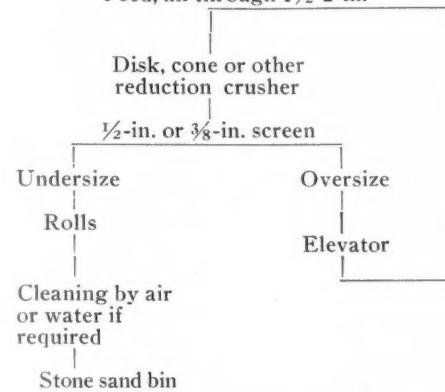
Rolls should always be run with mechanical feeders because a uniform feed is so essential to good work. They are more often run in closed circuit with a screen (to in-

sure that no oversize gets through) than in open circuit. But where it is a case of re-crushing screenings or crushing small stuff to sand size rolls can usually be run in open circuit and this is the best and the cheapest method.

The diagrams show methods by which rolls could be used for re-crushing screenings and for crushing coarse material to sand size. The latter might also be used for crushing gravel to sand size in localities where gravel is more abundant than sand.

These flow sheets are no more than suggestions but they contain what the writer believes are the essential elements for crushing from 2-in. to sand size. The first crusher should be of a type that has a high reduction ratio and a high capacity per

Feed, all through 1 1/2-2-in.



Flow sheet for soft rock that makes much fines and where product need not all pass 1/4-in.

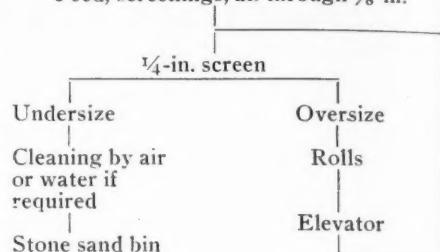
horsepower hour. The second should be one that is efficient in crushing from 3/8-in. or 1/2-in. to sand size. The mesh of the screen divides the work between the two crushing devices and should be chosen to keep both machines at capacity. Rolls may or may not be in closed circuit but they will have to be if the coarsest size of the product is strictly limited, such as all through 1/4-in.

A method of cleaning the product from dust and dirt has been included because this will often be required by specifications. A simple form of air separator would be better if the material was dry enough to permit its use. If not, some simple form of washer would have to be used. The fact that the material needs to be air cleaned should not deter one from trying to make stone sand as neither the device nor its operation need be expensive. It may be a commercial machine or a home made device.

A simple air separation may be made by passing the material over a vibrating or shaking screen which is covered with a hood connected to a suction fan and a cyclone. The hood should be arranged so that most of the air that goes to the fan comes through the screen. The writer has seen an efficient air separation made in a long vertical wooden spout. The upper end was connected to a cyclone collector and a fan

so that the dust was taken out before the air reached the fan. This was used to clean crushed silica sandstone. As a market can be found for really fine dust from almost

Feed, screenings, all through 3/8-in.



Flow sheet for re-crushing screenings

any common rock, the expense of cleaning stone sand of dust may often be repaid by the sale of the dust.

Cement Markets of Brazil

INFORMED OPINION in Brazil appears to be that consumption of cement will increase in the next few years, and that the resumption of public construction or of general building will greatly accelerate the growth of this market. There is a wide range of possible applications for this material, and the only question appears to be when general economic conditions are likely to return to normal.

It does not appear likely that portland cement manufacturers in the United States will be able to secure much of the prospective cement business because of the landed cost of their products as compared with those from Scandinavian and other European countries. On the basis of the official import figures, American participation in this market is very slight, and it is generally believed to consist of white cement entirely. Practically no portland gray cement of American origin has been sold in Brazil for the past 10 years.

During the first 5 months of 1931 Brazil imported 397,922 bbl. of cement, of which 91,240 came from Germany, 82,961 from Sweden, 72,643 from Belgium, and 70,110 from Great Britain. Only 2,093 bbl. were brought from the United States. Domestic production, sales, prices and containers are also discussed in detail in Special Circular 17 of the Minerals division of the Bureau of Foreign and Domestic Commerce.

At present, owing to the economic depression, it is practically impossible to foretell any consumption trends. Prior to the slump in the price of coffee, which commenced early in 1929, there was a heavy demand for cement for construction of roads, buildings, harbors, and other public works. Because of the depreciation in the price of coffee, and the political and economic uncertainty, practically all construction programs are at a standstill.

Consumers of foreign cement show no preference for any particular country of origin. They are concerned with price.

Lime Production Methods of Europe and America

Part VIII—Graduated Linings for Lime Kilns

By Victor J. Azbe
Consulting Engineer, St. Louis, Mo.

In the field of chemical engineering there are few combinations of greater importance than those caused by the combinations of CaO , Al_2O_3 and SiO_2 . To a manufacturer of clay ware or of cement or hydraulic lime the various combinations of one with the other are paramount. They are of great interest to the lime and cement manufacturers because both the quality of the product as well as the life of kiln linings is dependent upon this relationship. That this is so is peculiar, but it is so. The cement manufacturer is anxious to have the alumina, silica and lime in the kiln charge combine properly, but it is not at all anxious to have the alumina and silica in the brick combine with the lime of the charge. Even the fusing point of coal ash and formation of clinkers and formation of blast furnace slags is in many ways dependent upon the $\text{CaO}\cdot\text{Al}_2\text{O}_3\cdot\text{SiO}_2$ relationship pictured in Fig. 103.

The diagram shows the fusing point of three pure substances, or of any compound or mixture of either two as given in the three quadrangles, or of any compound or mixture of all three given in the center triangle. It is shown that pure lime has a fusing temperature of 4658 deg. F., but a mixture of 23.3% CaO , 14.7% Al_2O_3 and 62.2% SiO_2 , a fusing point of only 2138 deg. F. On the diagram, cement, hydraulic lime, pure lime, and brick slag can be found with the sole difference in proportions of the three actors and often no difference at all. The diagram shows the fusing point of fire brick of different silica and alumina content and it shows the fusing point after the brick becomes contaminated with lime. It shows not only the fusing point of the substance as a whole but of the different phases of which it is composed and so, in a way, the softening point as well. All the many slags found in a kiln are somewhere on the diagram, and upon their locations depend their fusing and softening points.

A ternary diagram is to some hard to understand, but to those who are familiar with topographic or weather maps it should be simple. The various numbered lines are merely isotherms, and represent temperatures at which the substance fuses. Even those, however, familiar with the reading of the diagram fail often to fully imagine the startlingly great differences found in the different regions. For those, a three-dimen-

Editors' Note

IN the preceding article, Part VII, the factors governing the selection of lime kiln refractories were discussed and their desirable characteristics shown.

This is continued in the present article and carried further into the realms of the binary and ternary diagrams showing the fusing points of various compounds of lime, alumina and silica.

The author brings out the advantages of a graduated lining made up of brick of different quality according to the heat conditions in the kiln and gives a specific example of this.—The Editors.

complished more than most geographers tracing out the four corners of the world.

In Fig. 103 only part of the inner portion of the diagram is given, and 1, 2, 3, 4, 5 and 6 represent regions of different grade brick. The first, or 1, is a very high alumina low silica refractory, while 6 is a silica brick. All of them are in fusing regions above 3000 deg. F. After being in contact with lime at high temperatures they will, however, combine in part with the lime and change their characteristics, forming low fusing point slags. The low alumina brick 5 will tend to form a slag of region 7, which has about the lowest fusing temperature, in one phase as low as 2138 deg. F.; the slag 8 from brick 3, being of higher alumina content, will not have such a low fusing point. The improvement progresses and brick 2 and 1 of high clay of exceptionally high alumina content will form high alumina, low silica, high fusing point slags. A study of the ternary system, taking into account also the relative porosities of the several classes in alumina content, indicates that in that portion of the field which contains normally the slags encountered in lime kiln service, the softening point temperature of the 80% alumina brick is probably 300 to 400 deg. F.

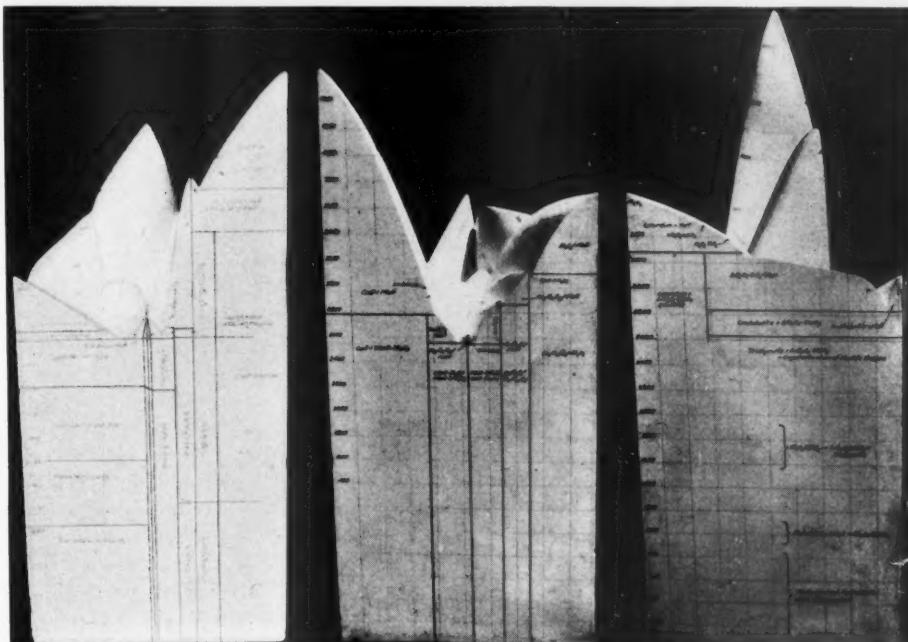


Fig. 104—Three dimensional models of the diagram shown in Fig. 103

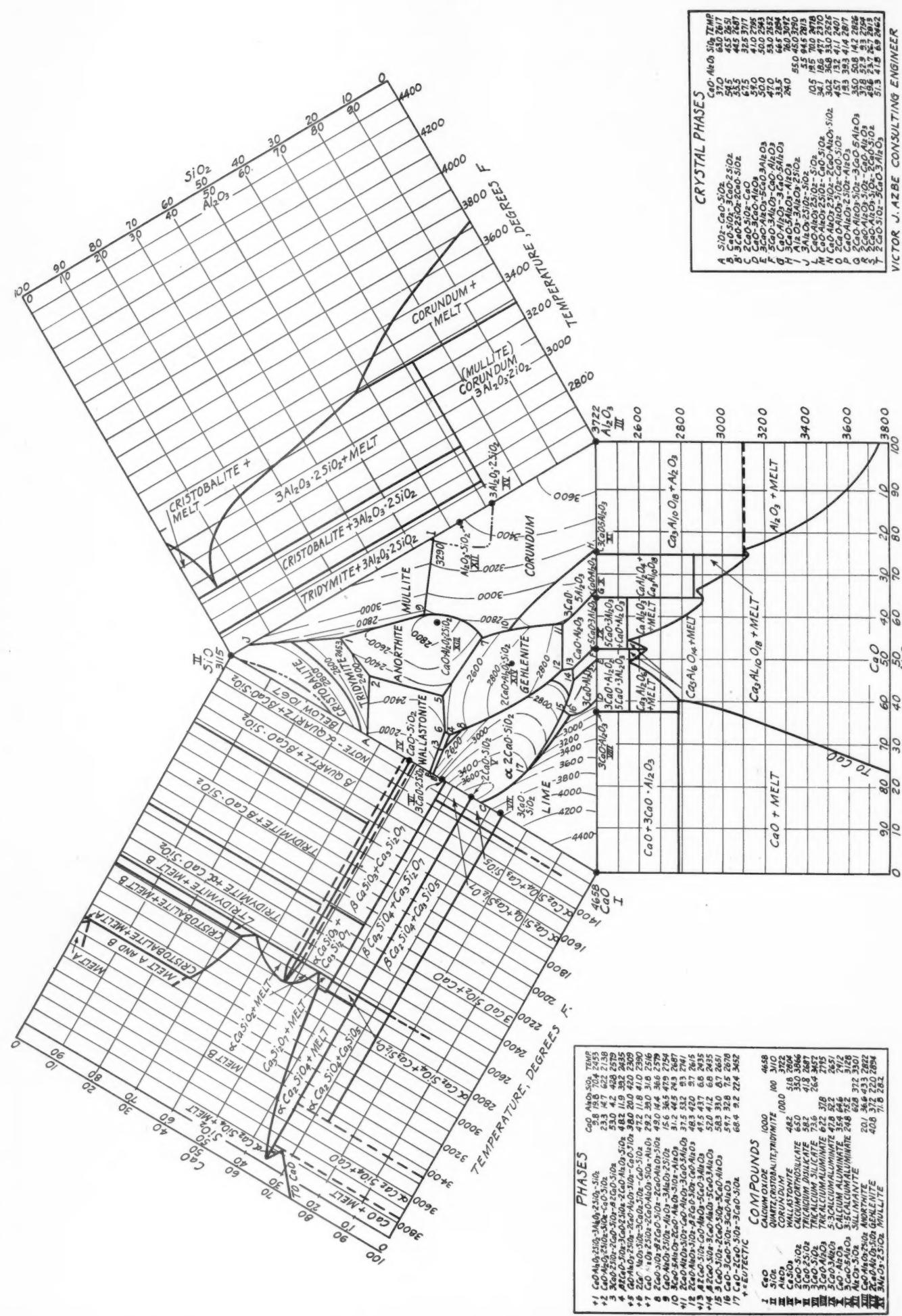


FIG. 103.—Binary and ternary systems of CaO , SiO_2 and Al_2O_3 as developed by Rankin and Wright, Bowen and Grieg, and Rankin and Merwin.

higher and of 70% alumina brick about 200 deg. F. higher than the regular first quality clay brick. Also these high alumina classes cannot readily form eutectics of dangerously low fusibility, as all the low fusing point eutectics are low in alumina content.

The best in alumina refractory is thus 1, at one side of the field. The best in silica refractory is 6, on the extreme other corner. In between is something inferior. But why should silica brick be superior? Theoretically it appears unsuited for a lime kiln, as silica brick is an acid refractory and it would appear that it would react chemically with the basic lime, with a very extreme fluxing action. However, at the temperatures at which lime kilns are usually operated this reaction does not take place, since silica brick is, to a great extent, a

Unfortunately, however, brick is not composed altogether of silica and alumina. There are other substances present; alkalies that act as fluxes and lower the fusion point to below that shown by the diagrams, 103 and 105. The purer the brick in this respect, the better. One of the undesirable substances is iron, which, in an oxidizing atmosphere, does little harm; but in a reducing atmosphere, that is, an atmosphere with no free oxygen and with carbon monoxide present, may, however, lower the fusing point of brick a couple of hundred degrees. It also lowers the softening point. High alumina refractory is likely to be low in iron, say 1.8%, while good grade fire clay brick may contain over 4%. As it is desirable for thermal efficiency to operate lime kilns with a very low excess of oxygen, under which conditions there will

be zones strongly reducing in character, which are most likely to be the highest temperature zones immediately above the burners, particular attention should be paid to the iron content of the refractory.

However, it is not only the fusing and softening points, composition and impurity content of the brick that determine the life of lime kiln linings. The charge of lime also contains impurities that may be an important factor. It is said that lime

has a very high fusing point, 4658 deg. F., a couple of thousand degrees above the kiln temperatures, but that is only when it is absolutely pure. All lime has some silica and some alumina, and sometimes a considerable amount. These impurities will combine with lime to form various calcium silicates or calcium aluminates or tertiary combinations of CaO , SiO_2 and Al_2O_3 which will have a low fusing point and which will give the lime in the kiln a certain amount of fluidity or softness. When the lime in the kiln gets very hot it becomes plastic because of these compounds, and in that state the combination readily takes place with the brick lining. In this respect one must also remember the very important fact that the formation temperatures of silicate slags are lower than the temperatures at which formed silicates melt, provided the compounds are ground finely and mixed intimately, or when the solids are thoroughly disseminated. The combination of SiO_2 or Al_2O_3 in lime will thus combine with CaO at temperatures below those shown in the diagrams, which is desirable when

cement slag or hydraulic lime are manufactured but not so when chemical lime is wanted or when long kiln lining life is desired.

Graduated Kiln Lining

It is impossible to say that such and such a lining is the best to use in all cases, because kilns are operated under many different conditions. They may be hand or gas or mixed feed fired; they may operate under oxidizing or reducing conditions; they may be forced heavily or be operated at low rates; combustion conditions may be such that the flame will be long and mild or short and intense; induced draft may be used, or natural draft; the drawing of the kiln may be continuous or it may be drawn every six hours; the lime may stick or may slip; the flow of lime through the entire kiln may be uniform or it may incline to hold back in certain portions; the lime may be pure or may be contaminated; the kiln may be readily trimmed or the lime may incline to hang, requiring long, laborious efforts to bring it down, and during which time the interior would be cooled. All of the above conditions have something to do with the kind of lining to use. Generally speaking, however, the lining will be of some alumina-silica combination or of silica brick.

As to the effect of lime on the fusing point of a refractory, considerable is known. Theoretically it is possible to predict what fusing point an alumina refractory will have when lime is admixed in certain definite proportions. A sample of 73% alumina brick was ground and mixed with 5, 10, 15 and 20% lime, formed into cones and placed in a high temperature furnace. The result was a continual lowering of fusing temperature with the increase of lime content as shown in the following table:

EFFECT OF LIME ON 73% ALUMINA REFRACTORY

% lime admixed	Fusing point, deg. F.
0	3300
5	2850
10	2642
15	2534
20	2390

Similar tests made with refractory materials of different alumina content show the same lowering of the fusion point, but the high alumina and medium-high alumina samples at high lime contents show less difference and so apparently give little advantage for the high alumina refractory. This, however, can hardly be so, as there is a decided advantage for high alumina in practice, because in the kiln the high alumina refractory has a higher softening point and in the more solid state is less inclined to combine with lime. In other words, a high alumina refractory will remain a high alumina, high grade refractory longer and will not lose its characteristics as quickly, because in the more solid state the combination of lime with silica and alumina is much slower.

Even after a high alumina brick has absorbed a certain amount of lime, the effect

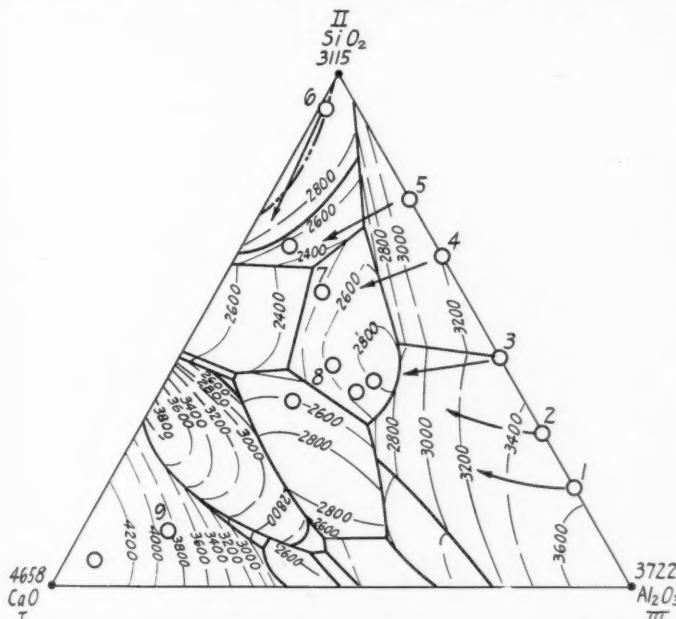


Fig. 105—Some silica alumina refractories and their resultant slags

pure, uncontaminated body and so has not the semi-fluid or softening point of clay brick, in which state the combination with lime is quite rapid. Also, when silica combines, if lime does not contain much clay, the slag that may form will be along the line of the arrow points, which means a high fusing point slag.

While all the slags so far mentioned were lime-contaminated brick, there is also a reverse to the order, and at 9 there are refractory coatings consisting in the main of lime with some alumina and silica from the brick. These coatings are highly desirable, as they have a very high fusing point and so at ordinary temperatures remain fairly solid and therefore tend to protect the brick below. They are formed in cement kilns by operating a newly lined kiln with a high lime charge at a temperature above normal temperature for the required period of time. These coatings are not glassy and to a large extent consist of free lime cemented together and to the lining by higher silica and alumina slags.

under load should be less serious, because there will be a greater amount of solid, free alumina present compared to the amount of liquid eutectics and so the body will be more solid and less inclined to lose from its surface by abrasion.

Condition of the alumina in the refractory is also important, that is, whether it is in the amorphous or crystalline form, or combined as the silicate forms. Thus in an underburned or improperly manufactured high alumina brick, a large percentage of the alumina might be in the amorphous form in which it was present originally in, say, diaspore, and as amorphous alumina it would be much more susceptible to attack by lime than the crystalline forms, for example, corundum. Similarly, the silicate combinations of alumina, for example mullite, would be more resistant to attack than the amorphous form, but probably not more resistant than the more refractory crystalline form, corundum. Also, the conversion of alumina from the amorphous to the crystalline forms is accompanied by a decrease in volume and increase in specific gravity, resulting in shrinkage, which should be eliminated in the manufacture for best results, and emphasizes the desirability of a properly manufactured high alumina brick.

This still is a somewhat mooted question and deserves the time and attention of some able investigator; however, the general indication is that high alumina refractory, though very expensive, should be justifiable in the most intense hot zones of the kiln, with lower and cheaper grades adjacent and still lower and cheaper grades in the comparatively mild section.

Fig. 106 shows a kiln lined with the above graduation in mind, a lining suitable for very severe conditions of operation, high capacity and high temperature.

(1) The first arch ring which is subjected to the most severe service is formed from the expensive silicon carbide. As this particular kiln is gas fired and most of the air comes up through the cooler and little in with the gas, conditions are reducing and it is safe to use silicon carbide which would not be the case if much oxygen were present in the stream flowing past the arch. With ordinary 40% alumina brick this arch ring gives out first and allows the flame access to two sides of the brick above, therefore, although the cost of silicon carbide brick is very high, still the expense is permissible, particularly as there are only few to buy.

(2) The second arch ring is of a lower grade compared with silicon carbide, but in the clay refractory scale it is at the apex, with its content of about 80% alumina. The cost is \$250 per M., still too high to line the entire zone, and its use is only permitted in a limited way at the most severe points.

(3) Around the arches and up to a height of 9 ft. the next grade refractory of 70% alumina content is used, costing \$150 per M. This zone, outside of the arches, is the most

severe on the refractory and so the use of a comparatively expensive material is permissible.

(4) The next zone above is lined with 60% alumina refractory for a height of 6 ft. and following that there is no reason to use anything but 40% alumina brick excepting in the uppermost kiln portions where a very hard brick is used to reduce breakage due to the bouncing rock.

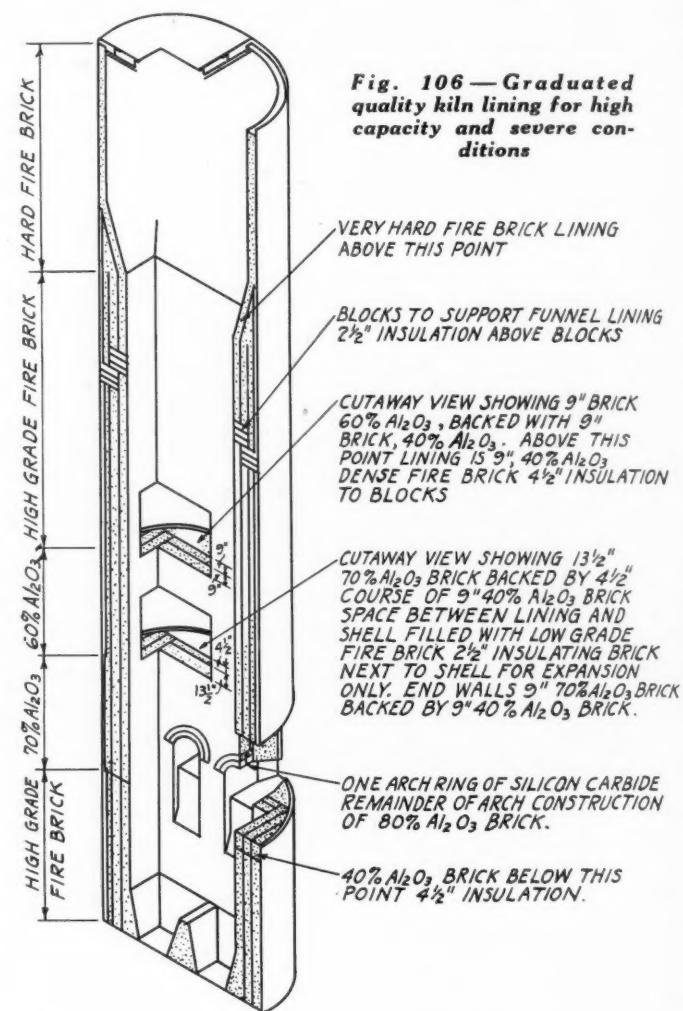
In the hottest zone side walls the shapes used are 3x6x13½ instead of 2½x4x9 and by their use several things are gained. First, the joints are greatly reduced, making the wall more solid, more impervious, less inclined to sag; then, also, by making the first course 13½ in. the kiln can be operated longer before it needs to be taken off the line for repairs, probably 50% longer than if 9 in. shapes had been used.

To help further, the hot zone is not insulated to any great extent and the heat dissipated from the wall just cools the inner course of brick and while this probably does not reduce the surface temperature much, it certainly reduces the temperature below the surface and so combats the tendency towards the softening and chemically more active state. It is true that by not insulating some very valuable heat is lost; that is all, however, compensated for if in turn greater dependence can be placed on the refractory and the kiln operated at a higher capacity.

The brick in the hot zone should be laid up with something superior to or at least as good as the brick itself. The fire clay of which the brick was made is far from something as good as the brick and even when the material is the very best as little as possible should be used. The clay in the joint will shrink in most cases and even if it does not, it will be porous and will readily combine with lime and slag so that the slag will penetrate into the adjacent brick structure and destroy it. Also when fire clay is used the wall will never be very solid. In part the clay will vitrify and form a bond with the brick and so a solid structure and in part it will fail to do so; thus the wall as

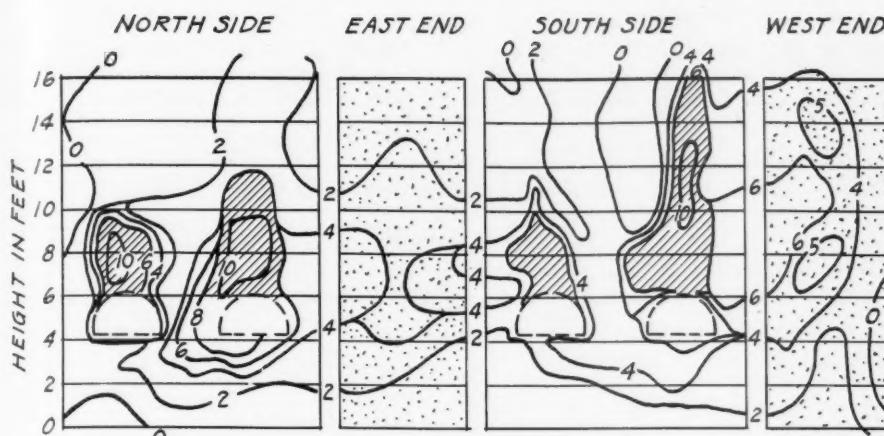
a whole will be weak and unsuitable for any load, inclined to sag, to crack and then to fall out altogether as shown in Figs. 96 and 97.

There are many special bonding materials on the market posing under trade names which are comparable to patent medicines and like them of little value. A bonding material to be good should be basic or neutral in nature. It should not contain as a binder sodium silicate which causes formation of low melting point silicate slags; it should not shrink or expand greatly in relation to shrinkage and expansion of the brick; it should form a tenacious bond; and



its main body should be a highly refractory material so when the wall surface goes, the joint will be the last to go and not the first as is so plainly visible in Fig. 96.

One of the recent very promising high temperature cements contains as the main body cromic oxide Cr_2O_3 . It has a softening point of 3450 deg. F., a bonding strength of over 325 lb. per sq. in. and is resistant to slag formation as well as slag penetration. Whether this material is the best we do not know, but its characteristics certainly are desirable and all of the higher grade brick used in the high temperature zone should be laid with it or something having equal characteristics.



NOTE: HEAVY LINES CONNECT POINTS OF EQUAL WEAR, FIGURES SHOW WEAR IN INCHES.
SHADED AREAS SHOW WHERE 9" BRICK FELL OUT.
LINES WITHIN SHADeD AREA SHOW WHERE SECOND COURSE WAS BURNED.
DOTTED LINES ARE OUTLINES OF FIRING EYES.
DOTTED AREAS HAVE BEEN IN SERVICE TWO RUNS OR MORE.

Fig. 107—Plan of wear of gas fired lime kiln

After the wall is completed an effort should be made to make its surface more or less impervious. In cement kilns that is done by the formation of a high temperature slag which prevents the contact of lime with the brick. In vertical kilns that is not possible, so the wall should be coated. Occasionally common salt is used for this purpose, the chlorine of the NaCl disappearing while the sodium combines with silica and alumina to form glazing; however, this glaze has a low fusing point so it is not very desirable. Aluminum sulphate would be preferable. This salt would also decompose and the alumina remaining would make the surface of the wall denser by filling the interstices. When pores are rather large the salt solution should contain some bauxite or preferably precipitated alumina because bauxite contains too much iron.

How much of a coating and what protection is obtained by the above method is not very well known, but certainly some, although hardly as much as might be desired. So probably the best procedure is to plaster the wall to a depth of $\frac{1}{8}$ -in. with the material previously recommended for laying the brick. With such a covering, as long as it is present, the brick underneath is effectively protected.

Recording Kiln Wear

Little is known about the wear of kiln linings because no one has had a suitable system of keeping a record. Just where and why and how much the lining did wear out the bricklayer knows, but even he knows only a little about it and he does not know anything about lime burning or about combustion or even about refractories. Fig. 107 is a practical illustration of a method of recording kiln wear. The plan is worked out from actual measurement according to a system that shows along which lines the wear is greatest, where the highest grade brick is necessary and where $13\frac{1}{2}$ -in. shapes are required in preference to 9-in. shapes.

A study of this plan reveals that in this particular case applying superior materials at certain critical points the life of the lining would have been possibly doubled.

(To be continued)

Refractory for Lime Kilns

A RECENT ISSUE of *Chemical and Metallurgical Engineering* carries a story on the burning of oyster shells into lime and the development of refractory brick manufacture from magnesium oxide (artificial periclase) by the Sierra Magnesite Co., Porterville, Calif.

Shell dredged from banks in the lower bay is thoroughly washed on the dredge, barged to the plant, and burned in a rotary kiln, which is followed by a rotary cooler, storage bins, continuous hydrator, mill, etc. The plant is unique in that while regularly producing lime for normal markets, it is pointed primarily toward the preparation of a material of unusual properties for the magnesia-products plant. It was found some time ago that the reaction properties of its commercial magnesium oxides depended upon the processing time-temperature.

To develop the desired characteristics in oyster-shell lime, however, required temperatures as high as 1600 deg. C., and no ordinary or even high-alumina firebrick would withstand such a temperature under the conditions existing in a rotary lime kiln. However, the use of a periclase refractory, made from relatively pure magnesium oxide, in the rotary kiln permitted any temperatures attainable by combustion of fuel, even with preheated air, without the slightest lining attack. Oyster-shell lime, burned at these abnormally high temperatures, is stated to be very pure and high grade. It was not possible, however, to obtain these temperatures with natural gas.

High-purity artificial periclase was first produced at the Porterville, Calif., plant of the Sierra Magnesite Co. some five years

ago, it is stated, and production has since been improved to the point where high-purity periclase is now available at low cost. The refractories produced from this material, which has properties of high load resistance and freedom from spalling formerly believed impossible in a magnesium oxide brick, are now being offered by several refractory manufacturers at prices equivalent to those demanded for normal magnesite brick.

A new manufacturing plant with a capacity of 12,000 to 15,000 tons yearly is being constructed at the Bald Eagle mine, some 16 miles from Ingomar, Calif. The magnesite or magnesium carbonate occurs 4 to 12 ft. thick in decomposed serpentine, and aside from 2% of calcium carbonate contains only very small amounts of other impurities. It is crushed and screened and then calcined in a 6-ft. by 100-ft. periclase-lined rotary kiln which is fired with oil. Both caustic-calcined and dead-burned magnesite, as well as artificial periclase, will be made. The products will be transported by truck to a loading and grinding plant at Ingomar on the Southern Pacific railroad. As soon as the new plant is operating smoothly the Porterville plant will be shut down.

Cement Markets of Bolivia

ESTIMATES place annual consumption of cement in Bolivia at about 50,000 bbl. Since it is not used to any considerable extent for small houses and buildings, the demand is naturally restricted.

The principal uses for cement are therefore in connection with office buildings, warehouses, modern and fairly expensive residences, and paving in the larger cities.

The cement market is suffering in proportion to the domestic markets for almost all important commodities. Improved conditions will likely increase activity, and the demand for cement will undoubtedly expand.

Cement is imported from a number of countries, Great Britain, Yugoslavia, Belgium and Germany being the most important. Much of the cement imported, particularly from Belgium and Yugoslavia, is natural and not portland. Cement produced in the United States is unable to compete seriously on account of its relatively high price, and consequent imports from that country are small.

Special Circular 15 of the Minerals Division of the Bureau of Foreign and Domestic Commerce, in addition to the above, contains information on local production and prices.

Refractories Institute Resumes Technical Bulletins

THE AMERICAN Refractories Institute, Pittsburgh, Penn., announces it has resumed publication of monthly technical bulletins.

The mailing list for these publications is now being formed. The first issue of this bulletin discusses kiln marking of fireclay brick.

Analysis of Properties Desired in Masonry Cements

By F. O. Anderegg, Ph.D.

Consulting Specialist on Building Materials, Pittsburgh, Penn.

DURING THE INVESTIGATION of the problems of the leaky brick wall¹ an unusual opportunity presented itself of making a scientific study of masonry mortars under conditions which allowed a close correlation with practical brick laying. The analyses of the properties desired in masonry cements and the series of tests devised for evaluating the properties are an outgrowth of that investigation.

The properties of importance in masonry cements include: workability and sand carrying capacity, bond strength, water-tightness, weather resistance, flexibility, shrinkage and shrinkage rate, compressive strength, together with freedom from efflorescence. For Indiana limestone masonry the staining effect of the cement on the stone must be considered and when colored mortars are used the fading factor becomes of interest. It is believed, as a result of conversation with a large number of masons, contractors, building engineers, architects, cement and lime manufacturers, and others interested, that this list pretty well covers the qualities of appreciable importance in mortars.

Mortar is made up of fine aggregate and cementing material, both contributing to the final result. Some of the relationships between sand properties and mortar quality have been discussed elsewhere;² this article is confined essentially to the cements in masonry mortars.

Workability and Sand Carrying Capacity

The weak point in the wall usually is the bond between the mortar and the masonry units and one important quality needed for good bonding is good workability. This, while influenced to a considerable extent by the grading of the sand,³ depends also markedly upon the cementing materials. Without sufficient workability it is difficult to get the good contact between the units and the mortar needed for a tight wall.

In addition, during the erection of the wall the workability of the mortar is very important, for upon it depends the amount of work accomplished. It is estimated by large building contractors, who are in a position to know, that the difference between a mortar of good and one of poor workability, in the amount of wall laid up, may be as great as 20%. This does not necessarily mean that it is essential to provide the mason with something as soft as "ice cream" to play with; but most mechanics do take pride

Synopsis

THE investigation of leaky brick walls led to a study of masonry mortars under practical conditions. From this study an analysis of the properties for masonry cements indicates the importance of workability, adhesion to masonry units, compressive strength, weather resistance, water-tightness, volume change, flexibility, efflorescence, fading and staining.—The Author.

This is the first of three articles by Dr. Anderegg on masonry cements.—The Editors.

in their work and with a properly workable mortar they can do a much neater job. In addition, the waste of mortar is reduced.

The sand carrying capacity is one of practical interest to the contractor who pays for the mortar and it has important bearing also on the quality of the masonry work. A harsh sand, full of voids, may require so much cement that the mix is too rich and shrinkage cracks abound. Very occasionally a sand is found which will give adequate workability with insufficient cement to give satisfactory weather resistance. Sands, according to the grading and particle shape, vary considerably; for instance, one cement of high plasticity has been found by actual test to carry all the way from 2.3 to 5 volumes of different sands.

Bond Strength

The most important strength characteristic of masonry walls is the bond between the unit and the mortar. When walls are subjected to excessive vibrational forces, or to cyclonic⁴ or hurricane⁴ wind pressures, any failure that does take place is usually in flexure.

Among cements of similar workability considerable differences in bonding strength have been observed. Variations in modulus of rupture from 15 lb. per sq. in. with pure lime mortar to 100 lb. for pure cement mortar have been found with brick beams broken at 28 days. The lime usually has a greater bond strength than mortar strength, while the straight cement mortar behaves in just the opposite way, unless extraordinary pains are taken in the laying. Somewhere between these extremes lies a happy medium which will not interfere with the attainment of a proper balance among the other desirable

properties. It probably lies in the range of 30 to 50 lb. per sq. in. for the flexural strength of the joint.

Water-Tightness

One of the most important problems facing the building industry of today is the construction of brick work which will not leak. The role played by mortar in aiding to build a tight brick wall is considerable. In view of the fact that most of the leakage occurs between the mortar and the brick,¹ every effort should be made to produce a mortar that does not shrink from the brick.

The frequent use of flat roof construction with parapet walls, especially along the Atlantic seaboard where driving storms abound, has subjected the masonry wall to an insidious penetration of moisture through every tiny crevice. Openings between the mortar and the masonry unit¹ are caused by lack of wetting of the unit by the mortar or by shrinkage of the mortar away from the unit while still plastic in certain localized spots and valleys through which the moisture readily penetrates, or both (Fig. 1). This passage is far more serious than that through the capillaries within the mortar and is shown by Fig. 1, which is a slightly enlarged photograph with oblique illumination of the surface of typical mortar after detachment from the brick. The large depressions are wrinkles in the surface of the mortar resulting from a combination of insufficient pressure and workability. Some of the smaller depressions may be due to shrinkage while the mortar is still plastic. The initial shrinkage of the mortar is most harmful in the vertical joints.

Prevention lies in securing adequate contact between the brick and the mortar so that the unit becomes properly wet. The factors contributing to this² are a properly plastic mortar whose surface tension has been reduced (best by a stearate soap). If the absorption rate of the masonry unit is greater than 3% of its weight in 10 minutes (4 or 5% in winter time) it should be wetted. The mason bears a considerable responsibility in this connection; if he simply places the best masonry unit on a bed of the best mortar with little or no pressure the bond will be imperfect—some force is required. Again an important contribution may be made by the mason; if he will wait till the mortar has stiffened to a point corresponding to the initial set, before giving the

final tool finishing, and if that is done with a round tool to force the mortar against both sides of the joint, less opportunity occurs for moisture to enter.

The reduction of the shrinkage of mortar away from the unit occurring while the mortar is still plastic may be brought about by controlling the rate with which moisture is removed from the mortar. The best way to do this is through a properly distributed stearate waterproofer. Lime putty is very helpful also.

Weather Resistance

The durability of a mortar is worthy of consideration. Where a wall is protected by projecting eaves the resistance required is not as great as for mortar used in buildings which are buffeted by driving rain storms.

Chimney and parapet walls, even in island regions, are subject to severe exposure and materials used in their construction should be able to resist, to a reasonable extent, the erosive effect of the driven rain and snow and the solvent action of that dilute solution of sulfuric acid, rain water. In addition, sulfates tend to accumulate within a porous material, with resulting crystal growth under changing conditions of moisture and temperature and the production of serious disrupting forces. The character of the cement determines largely the porosity of the mortar and the resistance to these crystal pressures.

Flexibility

Buildings are constantly undergoing movements of various kinds: the side on which the sun shines is expanding, while the side upon which a cold wind is blowing is contracting; during heavy storms buildings may rock under the buffeting of the wind; vibrations of one kind and another occur in many buildings; or localized movements, such as the freezing of moisture in a poorly filled head joint or the expansion of a coping under a summer sun may place an excessive stain on parts of the wall.

It is desirable to include in the mortar those materials which have the property of imparting a certain flexibility or resilience which will permit the mortar to take up these movements without being shattered.

Shrinkage and Shrinkage Rate

In considering volume changes in mortars in masonry walls one important fact needs considerable emphasis. As pointed out first by Davis and Troxell⁶ and confirmed by the writer,¹ mortar which has hardened in contact with absorbent materials has quite different volume change (and other) properties than if it hardens in contact with non-

absorbent molds. Therefore it is not safe to predict from results obtained either with mass concrete or with specimens made in metal molds in the laboratory what will happen in masonry walls.

As an instance, changes in length of mortar bars of portland cement or cement-lime mixes made in metal molds have been found by the writer to range between 0.04 to 0.08% on alternate wetting and drying, whereas the changes in length of 86 masonry panels built out-of-doors and measured with a strain gage before and after spraying and before and after a 24-hour driving rainstorm averaged below 0.02%. In these measurements, in addition to the lowered volume changes in

the rate at which moisture leaves the mortar while still plastic. Lime putty is also again helpful here.

Compressive Strength

It will be noted that the property of compressive strength, often considered to be of paramount importance in concrete, has been placed far down in the list. The mortar must, of course, have sufficient compressive strength to support the weight of the wall. As comparatively few buildings higher than four or five stories have load bearing walls, a very high compressive strength is not usually necessary. However, the strength result often gives information bearing on other important qualities, such as durability.

Typical building codes allow the architect to figure 200 lb. per sq. in. Then, if the mortar has a compressive strength of 1000 lb. per sq. in. (specimens made in contact with absorbent materials) a good factor of safety is maintained, together with desirable properties in reasonable balance and at no increase in cost.

Efflorescence

This phenomenon is the appearance at the surface of the wall of soluble salts brought there and left by moisture coming out of the wall and evaporating. When efflorescence occurs soon after erection the source is probably within the materials with which the wall has been built. The cement, the sand and the masonry units

should all be tested.⁴ When efflorescence appears after the wall has been erected for some time it indicates excessive moisture penetration into the wall. On drying out again the sulfates accumulated in the wall from the rain are brought to the surface and deposited as an unsightly scum.⁵ Cements chosen for masonry mortars should be practically free from efflorescent salts.

Fading

When mineral oxide pigments are added to mortar trouble is often experienced be-

References

¹Anderegg, F. O. Construction of Water-tight Brick Masonry, *J. Am. Cer. Soc.*, Vol. 13, p. 315 (1930); also *Architectural Record*, September, 1931.

²Anderegg, F. O. The Grading of Aggregates. II—Application of Mathematical Formulas to Mortars. *Ind. Eng. Chem.*, September, 1931.

³Report of the Committee on the St. Louis Cyclone, Engineers Club, St. Louis. As a result of the havoc wrought by the cyclone on weak masonry walls the committee recommended as a minimum amount of cement that contained in a 1:1:6 mix.

⁴Pearson, J. C. Hurricane Damage in Florida. *Proc. Am. Concrete Inst.*, Vol. 23, p. 319 (1927).

⁵Davis and Troxell. Volumetric Changes in Cement Mortars and Concretes. *Proc. Am. Concrete Inst.*, Vol. 25, p. 210 (1929).

⁶Anderegg, Peffer, Judy and Huber. Indiana Limestone, Efflorescence and Staining, *Purdue Univ. Eng. Sta. Bull.* 33, p. 51 (1928).

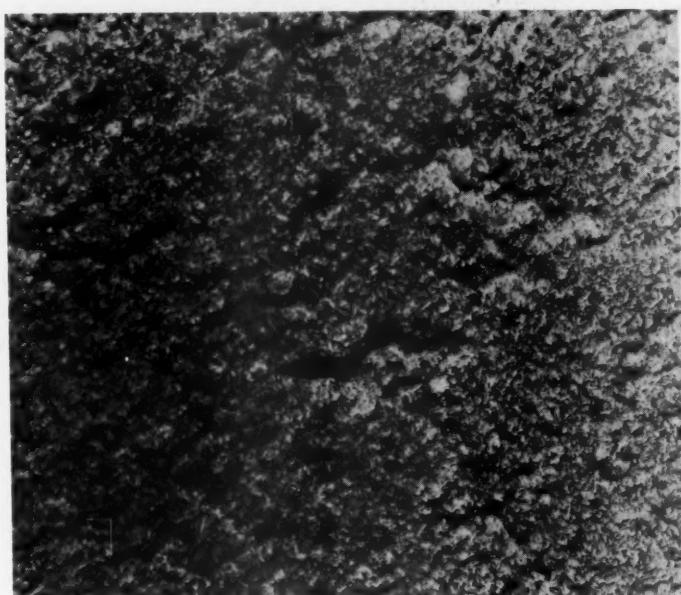


Fig. 1. Surface of typical mortar after detachment from brick

cause of their fading. This seems to be due to lime, and sometimes to other soluble compounds being deposited on the surface to obscure the coloring. Mortars waterproofed with paraffin or stearate seem to have less of this trouble than others.

Staining

Indiana limestone is stained at times by alkali compounds coming from the cement.⁴ The remedy consists in selecting cementing minerals low in soluble alkalies.

The Selection of a Cement for Mortar

The great variation in absorbing power, ranging from granite, marble and vitreous brick on the one hand to highly porous sandstones, limestones or brick, would seem to indicate the desirability of choosing a cement which will best fit the conditions.

For the former, a mortar of low water content would be desirable. This can be secured by careful grading of the sand,² by proper grading of the cement, by the choice of low bulking lime and with the aid of stearate waterproofing. For the latter, lime should be added, especially one having a "high yield." Stearate has been found helpful here also by slowing down the rate of moisture loss.

Having given a careful analysis of the properties important in a masonry mortar, the next step is to consider methods of evaluating them. These will be described in another article following.

Cement Chemists to Study Boulder Dam Requirements

A MEETING that will have an important bearing on the quality of cement which will be used in the construction of the Boulder Dam project was held at the Victorville, Calif., plant of the Southwestern Portland Cement Co. recently. A number of representatives from the chemical departments of many of the larger plants of the southwest met in a conference with government chemists in the research work.

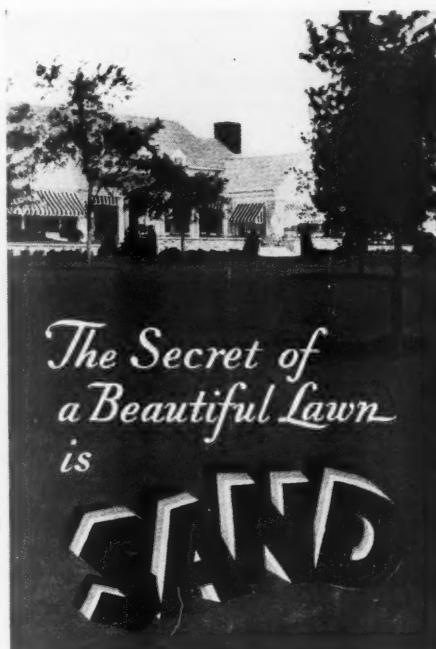
Several weeks ago a conference of government and cement chemists was held at Denver and at that meeting it was decided to hold all the experiments for the Boulder Dam project at the local plant. Since that time a number of government chemists have been visiting Victorville in this work. This conference was the first of a series which will be held there from time to time.

Present at the conference were Prof. Raymond E. Davis of the engineering department of the University of California; W. S. Trueblood, chief chemist of the Monolith cement plant at Tehachapi; Wilson Hanna and a party of three representatives from the California Portland Cement Co. of Colton, and Mr. Wood and several representatives from the Riverside Portland Cement Co.—Victorville (Calif.) *News-Herald*.

Rock Products

December 5, 1931

Developing New Market for Sand



Cover of mailing folder to promote use of sand on lawns

A DETERMINED and successful effort to win a new market for sand has been made by at least two producers during the past year. In Kansas City, Mo., the Stewart Sand and Material Co. has carried on a campaign to sell sand as a means to develop attractive lawns. A special grade of sand has been developed for this purpose.

In promoting this use of sand a small mailing folder was prepared, the front cover of which is herewith reproduced. This cover of the folder is in attractive colors. In addition, advertisements appeared in local papers, the two shown appearing in the rotogravure section of the Sunday edition.

Sand—the Secret of Beautiful, Hardy, Green Grass!

J. A. BOWMAN RESIDENCE, 1315 W. 6TH TERRACE
 This beautiful lawn was seeded in November, 1928. The following April it was scarified with sharp iron, raked and a commercial fertilizer applied at the rate of 12 pounds per 100 square feet. Each application of sand was broadcast over lawn and trowel beds. A second application of 5 tons will be made in December.

HOW TO APPLY SAND TO YOUR LAWN
 Rake off old grass and weeds, scarifying the soil to a depth of 1/2 to 1 inch. See lawns and where needed, thin, scatter sand over entire surface, about 100 lbs. or 5 gallons per 100 square feet. If no fertilizer is used, mix with sand and apply in same manner. A call or card will bring our representative and full information without obligation on your part.

STEWART SAND & MATERIAL CO.
 Main Offices—CITY BANK BLDG.
 Phone VI 5920

Reduced reproduction of an advertisement in a Sunday rotogravure section

Sand—the Secret of Beautiful Lawns and Green Grass!

View showing beautiful lawns and shrubbery of the Stone & Muller Undulating Roofing Co. of Ohio, Plain. Fifteen tons of sand were applied to these lawns in April, 1930.

Precious applications of sand contribute to the beauty of lawns, shrubs and flowers. Sand loosens the soil, thereby permitting moisture to penetrate the ground more freely, reducing evaporation losses. It is impossible to use too much sand on a lawn or in flower beds provided it is applied at intervals.

How to Apply Sand to Your Lawn—

Take off old grass and weeds, scratching or loosening soil as much as possible. Sow new seed where needed. Next scatter sand over entire surface, one-eighth inch deep (this requires about 100 pounds, or 8 gallons per 100 square feet). Water the new seed and sand thoroughly. Repeat the same process in other areas as you will bring our representative and fall information without obligation on your part.

STEWART SAND & MATERIAL CO.
Main Offices—CITY BANK BLDG.
Phone 71-2828

Showing actual results of application

be obtained from the state agricultural college or the U. S. Department of Agriculture. After such information is obtained a personal test is an excellent way to learn just what benefits may be anticipated from the treatment recommended.

Brown Earth Pigments

INFORMATION circular 6504 recently issued by the U. S. Bureau of Mines deals primarily with umber and sienna, together with other natural brown earth pigments, such as Vandyke brown or Cassel earth, Cappagh brown, Caledonian brown, Cologne earth, and mineral brown.

Umber and sienna are naturally occurring mineral pigments composed largely of clay permeated with hydrated iron (ferric oxide). They also contain hydrated manganese oxide. In addition to silica and alumina (clay) and the coloring oxides of iron and manganese, these pigments often contain lime, barium, and other metallic salts as impurities.

Sienna is translucent rather than opaque and is more of a stain than a pigment; as the iron oxide content is rather high (often 60 to 80%), the color is strong and rich and varies from pure brown to reddish brown.

Burnt sienna is a pigment of an orange-brown tint made by cautiously calcining raw sienna. It is divided into two grades, American and Italian burnt sienna.

Raw umber is a greenish to yellowish brown siliceous and ferruginous earth, containing a considerable proportion of one or other of the higher oxides of manganese. Umber is a permanent pigment, not being injured by light or by impure atmospheres.

Burnt umber results from the calcination of raw umber. The color is much richer and warmer than the raw umber.

Other naturally occurring earth pigments are Cappagh brown, Caledonian brown, Vandyke brown (Cassel earth), Cologne earth, and metallic or mineral brown.

Cappagh brown is a highly manganifer-

ous and ferruginous earth and assumes a fine reddish-brown hue like that of burnt sienna when heated.

Caledonian brown possesses a reddish tint and is composed chiefly of manganese and iron oxides and hydroxides.

Vandyke brown is applied more or less indiscriminately to pigments composed of clay, iron oxides, decomposed wood, peat, lignite, and other organic matter.

Cologne earth is a bituminous (lignite) Vandyke brown which has been gently roasted.

Metallic brown or mineral brown is made by calcining an impure iron oxide. It is variable in color but resembles burnt sienna.

All pigments consist of three parts: (1) The principal color-producing ingredient; (2) the secondary or modifying coloring ingredient; and (3) the base, filler, diluent, or carrier of the color.

There are two principal uses for umber and sienna—as a pigment in paints and for wood stains. As coloring agents they are also used in linoleum, oilcloth, paper, etc., and to a minor extent in the ceramic industry.

Ground sienna is used in comparatively large amounts for lithographic and typographic printing and as an artist's color—either alone or as a base for lake pigments upon which organic coloring matters are precipitated from solution.

Umber has similar uses in paints but has a greater covering power than sienna. A considerable quantity is consumed in the wallpaper industry. American umbers and siennas are used in the most part as pigments and stains in the less expensive paints and color varnishes.

The other earth pigments containing iron and manganese are used in the most part as substitutes for umbers and siennas.

Neither umber nor sienna is produced in large amounts in this country, chiefly for the reason that the products of certain foreign countries have established an international reputation for quality.

In the United States, deposits of umber have been worked near Bethlehem, Doyles-

town, and Bethel in Pennsylvania, while sienna has been produced near Reading, Penn., and at Valley Station near West End, N. J. Umber could be produced also in the ocher and manganese district in the vicinity of Cartersville, Ga., if the demand existed.

The following brief outline of the Italian method of mining and preparation of umber and sienna is taken from an unpublished consular report:

During the warm seasons the raw sienna earth is excavated, after which it is usually washed in tanks, and the sienna, containing perhaps 70 to 80% of water, is banked in small piles and left in the sun to dry. Burning the sienna is extensively carried on at the place of excavation, but the major portion is shipped to Leghorn in the raw state and there treated.

The requirements of the paint producers in the United States for umber and sienna are met primarily by imports. There is no known domestic production of Vandyke or Cassel brown.

Statistics are included in this report giving imports of these materials, tariff rates, and of prices over a period of years, both for domestic and imported materials.

Blasts at County Quarry Cause Complaints

HASTE in abandoning the county rock quarry near the Indian Hills residential section of Louisville, Ky., was seen after residents reported another detonation that scattered rocks, powder fumes and limestone dust over a wide area around the quarry.

A light breeze, it was reported, carried the fumes, dust and dirt to many homes within a mile of the place. Elijah Hedges, superintendent, said that the charges were light.

The Jefferson county fiscal court recently reached an agreement with Mrs. Edith Hardin, owner of some adjacent property, whereby Mrs. Hardin was to be paid \$2000 for immediate damages and \$125 a month after September, 1932, until the quarry is abandoned. Mrs. Hardin's offer to sell her property for \$15,000 was rejected by the court.

After damages were reported last year, orders were issued for no blasts to be set off within 10 ft. of adjoining property lines. The quarry has been owned by the county for about 12 years and County Engineer Drane estimated that it would be used three or four more years before abandonment.—Louisville (Ky.) Courier-Journal.

Better Molding Sand Business

MOLDING SAND shipments are on the increase from the vicinity of New Lexington, Ohio. More than 75 carloads of sand have been shipped in a week to various parts of the United States, it was recently reported.—Columbus (Ohio) Dispatch.

Ways of Cutting Electric Power Costs in Stone Crushing Plants

NOW, WHEN plant owners and operators are thinking about how to reduce production costs, any ways of reducing the cost of electric power should be of interest. According to some operators, such power costs are about 12 to 15% of the total production cost.

Some interesting information on this subject is given in an article by D. Lee Chestnut, industrial department, General Electric Co., Trenton, N. J., in the October, 1931, issue of the *Crushed Stone Journal*.

Nearly all power rates are made up of at least two parts: a "demand" clause, based on the maximum demand for power; and an "energy" clause, covering the actual amount of power used. Many also have a "power factor" clause which is to protect the electric company against the evils of a poor power factor. These three factors are explained and also ways of bettering the operating conditions are suggested in what follows.

Maximum Demand

The maximum demand is measured by most power companies by a meter which registers the total power consumed throughout the day during periods of 5, 15 or 30 minutes (depending upon the particular power company's standards) and thus shows on a chart the power demand for each period. Some of the fundamental ways of keeping down the maximum demand are:

1. Do not permit all motors to be started simultaneously at the sound of the 7 o'clock whistle. Authorize one man to start all the main motors, and see that there is some interval between starting of the larger motors at least.

2. Do not wait until stone is to be dumped into the main crusher to start all the motors. Have them running 10 or 15 minutes (longer in cold weather) ahead of the time the plant actually starts to work, so that the excess "warming up" load has dissipated itself before the plant load begins. The additional energy used will cost less than the saving made in demand.

3. Remember that any friction loads, caused by inefficient countershaft drives, add directly on top of the net useful load demand, and are always highest when the load is at its maximum.

Fig. 1 is an actual daily demand curve of a typical plant. The reason for the early morning peak seems to be that everyone is full of "pep" and everything soon gets into full swing. Gradually, as the day wears on, personal efficiency decreases slightly, and the load drops off. Obviously, the "turnover" of demand would be greater and the cost of operation lower—maintaining the same daily

tonnage—if the load could be averaged out by careful planning and supervision of production. One way to avoid peaks of this nature is to have a motor-operated feeder ahead of the main crusher. This regulates to a certain extent the flow of stone, and thus prevents overcrowding of the equipment. Some operators object to feeders on main crushers, where quarry loading is done by shovels larger than 1 yd. capacity. In these cases the use of a small bin to hold

is equipped with a receiver large enough to carry the plant for a few minutes with the compressor unloaded, then a demand control device, causing the compressor to unload at otherwise peak demand periods, could be used to advantage. It is possible, too, that these demand-limiting devices may be used to control adjustable speed motors operating feeders. The flow of stone could then be automatically regulated to give maximum production without exceeding a predetermined maximum power demand. Whether or not the investment in control devices would be justified depends upon the rate schedules and the demand charges.

Energy Consumption

The second part of the power bill—actual kilowatt-hours used—generally receives little attention from the owner or operator because he feels there is little he can do about lowering it.

The most effective way of lowering this is by more efficient handling of the stone through its various stages. It costs money for every foot that every pound of stone is moved, and that cost mounts proportionately as the route of the stone is up-grade. Every conveyor and elevator and every screen and crusher should be studied and its existence and location justified.

Also in the matter of drives the efficiencies are greater and the power consumption is less where each unit has its own motor than where there is any considerable amount of line shafting and belting.

Power Factor

Induction motors, either squirrel cage or slip ring, are so constituted that there is always some "useless" current which is out of phase with the impressed voltage and is doing no useful work. The ratio of the "useful" in-phase current to the total current is known as the power factor. Also, the "useless" current is practically constant at all loads, whereas the "useful" current varies almost as the load, from which it is evident that a lightly loaded motor has a lower power factor and requires proportionately more current for a given amount of work. In other words, a low power factor resulting from poorly loaded motors means that for any given amount of work the total current is greater than for fully loaded motors and that the lines, transformers and generators of the power company must be larger in order to carry this "useless" or "idle" current. Hence the power factor clause in power rates to reimburse the power company for this necessary excess capacity.

It is of course desirable to maintain as high a power factor, with as little "useless"

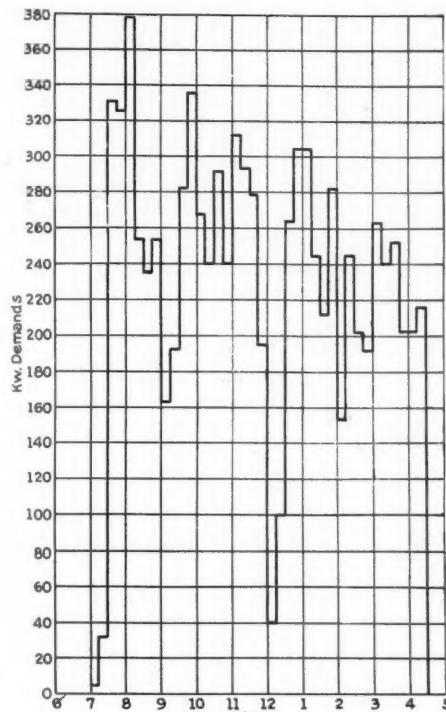


Fig. 1—Daily demand curve of typical plant

probably an hour's capacity, installed beyond the first conveyor or elevator, feeding the remainder of the plant through a motor-operated feeder, will generally serve equally as well.

Too often crushing plants operate at peak loads two or more times the average output, with the result that there is greater investment, higher demand and greater energy consumption than would be the case if the plant and work were planned for a more even production.

In some industries demand control devices to limit the demand to a predetermined point have been used successfully, but these are not as applicable to the stone industry, where it is difficult to arbitrarily remove any load at a particular time. If there is a motor-operated air compressor of fair size with respect to the plant demand, and if it

current as possible, and this may be done in the following ways:

1. Select motors of a size such that the average operating load, with respect to the motor ratings, will be as high as possible.

2. When applying induction motors use the highest standard speed motor (1800 r.p.m. or below) that can be properly applied to the drive, as the higher speed motors are smaller in frame size and require less "useless" current.

3. If pumps, air compressors, or electric shovels with Ward-Leonard control are used, requiring motors 50 hp. and above (sometimes even smaller), use synchronous motors on these drives. Synchronous motors can be designed to have no "useless" current and in addition neutralize some of the effect of the induction motor load.

Problems in Selecting Motors for Power Requirements

The first of these points is difficult of attainment in crushing plant service. Crushers must be motorized to carry the heaviest loads and at other times are necessarily under-loaded. Crushing operation also imposes extremely high peak loads, sometimes of appreciable time duration, and every operator prefers a motor large enough to pull through these normal peaks without stalling. Belt conveyors, and particularly bucket elevators, may have heavy friction loads at start, particularly if they have stopped for any reason while loaded, and the operating motor should have capacity to start them.

Other machines likewise require larger motors than would otherwise be necessary in order to take care of starting. All these drives are harder to start in cold weather. Thus a plant properly equipped to take care of the extreme conditions which must be considered as normal in this class of work often has a low power factor.

Ways of Improving Power Factor

Sometimes, however, a study of conditions will lead to some ways of improvement. As an example, a particular 30-in. belt conveyor was operated by a 25-hp. motor. A 15-hp. motor could readily carry the normal and peak loads of this conveyor, but when a truck load containing a large percentage of fine material was dumped into the crusher the fine material went through, clogging the belt and stalling even the 25-hp. motor. This is the type of condition which could probably well be remedied, resulting in improved power factor conditions.

When synchronous motors are considered for pumps, air compressors, or for the drive of a motor generator set on electric shovels, the use of "leading power factor" synchronous motors should be considered. It is frequently asked whether synchronous motors cannot be applied to crushers and thus get the benefit of power factor correction on these larger motors that necessarily operate well below their normal horsepower ratings.

This is a logical question, and is receiving more and more consideration. Strictly from a power factor standpoint, the application is extremely desirable. Some characteristics of synchronous motors, however, require very careful study of conditions before such applications are made.

A synchronous motor always operates at a certain definite speed from which it cannot vary. Hence when a crusher gets a sudden peak load the synchronous motor has no pity on it, but forces it to crush away at full speed. There is no cushioning effect. This puts heavy mechanical strains on the crusher and on the transmission between motor and crusher. Furthermore, the power lines feeding this motor must of necessity reflect these higher peak demands. An induction motor on the other hand has a characteristic permitting it to "ease off" slightly in speed during peak loads. Thus a crusher will get over a given peak with considerably reduced mechanical strain on itself and on the transmission, and with a lower electrical peak on the power lines.

However, with further modifications of synchronous motor design and strengthening of distribution systems it is possible that the use of synchronous motors will be extended to jaw crushers within a few years.

Use of Capacitor

There is another way in which any necessary power factor correction can be secured, namely, by the use of capacitors or condensers. This is an extremely reliable device with no moving parts, and consists essentially of two strips of aluminum foil insulated from each other, immersed in oil and hermetically sealed in a can. It requires no maintenance supervision. Power factor correction secured in this manner, however, is more expensive than for the equivalent amount secured with a synchronous motor. Thus capacitors are normally used only after synchronous motors have been applied wherever possible, but where still further correction is necessary.

Cement Markets of Peru

TOTAL Peruvian consumption of cement has shown a steady uptrend in recent years, growing from 251,000 bbl. in 1923 to 621,000 in 1929. Since 1924 imports have remained about the same, and the larger sales have drawn on increased output from the local factory.

Preliminary reports show that 108,598 bbl. of cement were imported during the first 6 months of 1930, a 30% falling off from the usual rate of importation, and the figure for the second half of the year will show a further decline as the result of the generally poor business conditions.

While the decreased consumption is a temporary result of the existing depression, no early improvement can be foreseen.

Peru has always imported comparatively large quantities of cement and the Lima district has been the best market, taking a little over half the total imports and practically all of the domestic production. Total local production and total imports are approximately the same, roughly 300,000 bbl. each.

Imported cement is sold direct to consumers by the large importing merchant firms, most of which hold exclusive agencies of foreign cement manufacturers, but the customary terms to consumers are 60 days. When there is plenty of construction under way or contemplated the merchant firms will carry good stocks but in dull times and in the case of large orders, sales are made on an indent basis and prices quoted to consumers, c.i.f. port of entry.

Price is the factor of prime consideration in the purchase of natural or portland cement in the Peruvian market. American cement of these varieties can not compete with domestic or European cement on a price basis. Occasionally small sales of American portland cement are made outside of Lima on a quality basis, or to American construction or mining companies. There is a fair demand in Peru for American white cement for the facing of concrete building construction.

Actual orders were placed by Lima importers in January, 1931, for Danish cement at the equivalent of \$2.20 per bbl., c.i.f. Callao, price to include the 2% ad valorem consular invoice fee payable to the Peruvian consul at point of origin. Japanese cement was quoted at the same time at \$2.25 per barrel and American portland cement was quoted at \$3.68, c.i.f. Peruvian ports, same terms.

Although the domestic cement can undersell the imported brands in the central district, substantial quantities of imported cement continue to enter through the port of Callao. This is due in part to the inherent prejudice of Peruvians against some articles made in Peru, and in part to the fact that large quantities for particular public works or private construction jobs of some ultimate benefit to the public are admitted duty free by special legislation.

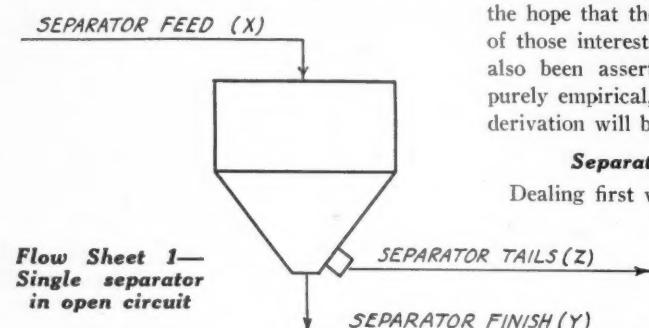
Domestic cement can not compete with foreign cement outside of the central district and, within this district it costs no more to bring foreign cement from the port of Callao than it does to move the domestic cement from the plant on the outskirts of Lima. The local company desires more tariff protection so that its product can compete with imported cement, outside of Lima.

In addition to the above, data on containers, domestic production and prices are given in Special Circular 14 of the minerals division of the United States Bureau of Foreign and Domestic Commerce.

Formulas Applicable to Air Separation

By A. W. Catlin
Consulting Engineer, Chicago, Ill.

THE ENGINEER or plant operator dealing with air separators must, of necessity, familiarize himself with the basic principles involved in air separation and must be able to analyze separator performance.



ance if he desires to approach the subject with any degree of certainty. The engineer is constantly confronted by the necessity of determining efficiencies of such equipment, as well as to ascertain total loads, circulating loads and tonnages of finished products, while the operator is frequently interested in making these same determinations. It is not always feasible actually to measure loads in the ordinary way, and, given certain known data, it is customary for those who have mastered the fundamentals of air separator calculations to compute the unknowns by the use of formulas.

While not incumbent upon the investigator to defend the use of mathematics in treating an engineering subject, it may be said at this juncture that a critic comes forward with the pronouncement that formulas are of academic interest only in this connection, and results, not abstruse calculations, are what count in the long run. Granting that certain problems associated with separator performance may be solved by the application of simple arithmetic, or that results may be approximated by the employment of rule-of-thumb methods, it does not follow that formulas are of no value when properly applied. Frequently problems are encountered which do not lend themselves to such casual treatment as has been suggested, and here is where the formula steps into the picture.

The formula, like the straight line, is the shortest distance between two points, and, once having been jotted down in the notebook, no effort of memory is required to bring it into play, and inasmuch as all formulas employed in connection with air sepa-

rations are equally applicable to other separating devices, such as screens and wet classifiers, they are of general interest. Manufacturers of separators do not make a practice of publishing formulas, and in response to numerous requests they are given here in the hope that they may be of value to many of those interested in the subject. As it has also been asserted that such formulas are purely empirical, which is not the case, their derivation will be given.

Separator in Open Circuit

Dealing first with a separator in open circuit, there are three tonnages which are given consideration, and these are designated as follows:

$$\begin{aligned} \text{Total load} &= X \\ \text{Finished product} &= Y \\ \text{Tailings product} &= Z \end{aligned}$$

It is also customary to designate the percentages of fines in separator feed and products as follows:

$$\begin{aligned} \text{Per cent. fines in feed} &= A \\ \text{Per cent. fines in tails} &= B \\ \text{Per cent. fines in finish} &= C \end{aligned}$$

In the following discussion, for the sake of convenience and uniformity, loads will be considered in tons per hour and fineness in terms of material passing 200-mesh, although, of course, any unit of weight or of fineness may be employed.

Flow Sheet 1 shows a separator in simple open circuit, from which it is obvious that

$$\begin{aligned} X - Y &= Z \\ \text{and} \quad Y + Z &= X \\ \text{or} \quad Y + (X - Y) &= X \end{aligned}$$

It is also self-evident that the total amount of fines going into the separator must equal the total amount coming out of the machine. The total input of fines is then represented by AX , the fines in the finished product by CY and the fines in the tailings by BZ , or as it may be expressed, $B(X - Y)$, therefore:

$$\begin{aligned} CY + B(X - Y) &= AX \\ CY + BX - BY &= AX \\ CY - BY &= AX - BX \\ Y(C - B) &= X(A - B) \end{aligned}$$

$$Y = \frac{X(A - B)}{(C - B)} \quad (1)$$

(Formula for obtaining tonnage of finished product.)

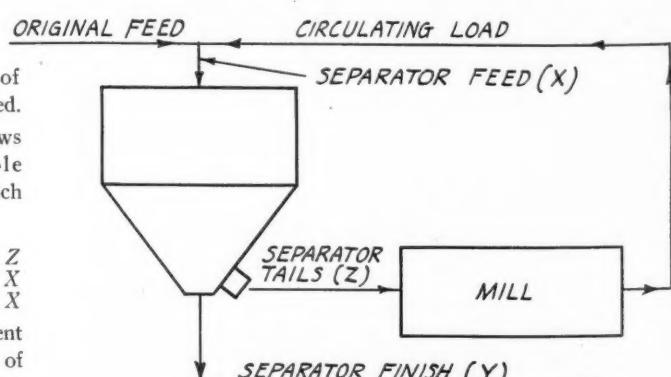
Therefore, knowing the value of X and determining the values of A , B and C by sampling and screening, we are able to compute the tonnage of the finished product, Y . However, the total load on the separator is seldom known in advance, and we are more likely to know the tonnage of the finished product. Transposing (1), we have:

$$X = \frac{Y(C - B)}{(A - B)} \quad (2)$$

(Formula for obtaining tonnage of total load.)

Formula (1) is developed at this stage principally for the reason that the value of Y as given is necessary in the development of the formula for efficiency which follows.

The efficiency of any selective apparatus, such as an air separator, is naturally the ratio existing between the amount of finished material recovered and the amount introduced into the machine in a given interval of time. If we feed a separator X tons of material carrying A per cent. fines and recover Y tons



Flow Sheet 2—Separator in closed circuit with grinding mill

carrying C per cent. fines, then the efficiency (E) is

$$E = \frac{CY}{AX} \quad (3)$$

But it has just been shown that

$$Y = \frac{X(A - B)}{(C - B)}$$

and substituting this value for Y , the formula becomes

$$E = \frac{CX(A-B)}{AX(C-B)}$$

Canceling X ,

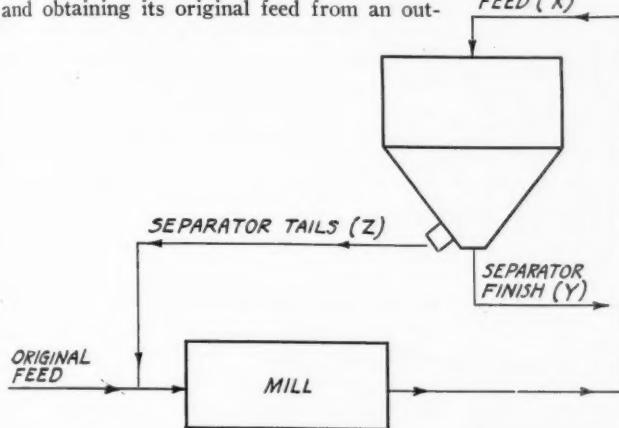
$$E = \frac{C(A-B)}{A(C-B)} \quad (4)$$

(Usual formula for efficiency.)

Consequently, by screening samples of separator feed, tails and finished product, the efficiency may be determined at once without regard to tonnage, which determination is not possible by arithmetical methods, where tonnages must be known.

Separator in Closed Circuit with Grinding Mill

On Flow Sheet 2 a separator is represented in closed circuit with a grinding mill and obtaining its original feed from an out-



Flow Sheet 3—A different closed circuit hook up

side source, such as a preliminary grinder. Here the tonnage of original feed must of necessity equal finished tonnage, or

Tonnage original feed = Y

In this case we have also a circulating load to deal with, the tonnage of circulating load being equivalent to the tonnage of tails, or

Tonnage circulating load = Z
and $Z = X - Y$

If we know the amount of original feed going into the separator, or if we know the amount of finished material Y coming from the machine, and represent the ratio of total feed to the separator, X , to the finished tonnage, Y , by R , we have

$$R = \frac{X}{Y}$$

Substituting in this equation the value of Y as given in formula 1, we have

X

$$R = \frac{X(A-B)}{(C-B)}$$

$$R = \frac{X(C-B)}{X(A-B)}$$

and cancelling X ,

$$R = \frac{(C-B)}{(A-B)} \quad (5)$$

Consequently, knowing Y , the total load on the separator can be determined very readily by multiplying Y by R .

Also, by transposing formula 4 we find,

$$B = \frac{AC(1-E)}{C-AE} \quad (6)$$

In a similar manner we also determine

$$R = \frac{C}{AE} \quad (7) \quad X = \frac{CY}{AE} \quad (8)$$

$$\text{and } Y = \frac{AEX}{C} \quad (9)$$

Reverting to Flow Sheet 2, an example will be given.

Original feed to the separator carries 45% of 200-mesh material and amounts to 60 tons per hour. The total separator feed runs 60% 200-mesh, separator finish 90% 200-mesh, tails 36% 200-mesh, and these are reground in a tube mill to 72% 200-mesh.

To Determine Load, Feed and Efficiency

It is desired to know total load on the separator, the tonnage of tube mill feed and separator efficiency.

$$\text{From (5)} \quad R = \frac{(0.90 - 0.36)}{(0.60 - 0.36)} = 2.25$$

Then total load,

$$X = 2.25Y$$

or $X = 2.25 \times 60 = 135$ tons per hr.

Total tube mill feed,

$$Z = X - Y$$

or $Z = 135 - 60 = 75$ tons per hr.

Efficiency,

$$E(4) = \frac{.90(.60 - .36)}{.60(.90 - .36)} = 66\frac{2}{3}\%$$

On Flow Sheet 3 is shown a variation of Flow Sheet 2, where the

original feed by-passes the separator. Here the original feed must equal Y as before, and in this case the tube mill feed is a composite, whereas the separator feed on Flow Sheet 2 is a composite. Calculations are made for this case as already indicated.

On Flow Sheet 4 is represented an actual problem encountered in a plant where a pair of separators, running in parallel, were handling an original feed from preliminary grinders carrying 48% 200 mesh. The separator finish ran 93% 200 mesh, tube discharge 70% 200 mesh, and tails 43% 200 mesh. It was ascertained that the tube mill

was grinding at the rate of 50 tons per hour. Not being convenient to measure the tonnage of separator finish, tonnage of original feed and fineness of separator feed, the problem was to compute the amount of finished material coming from separators.

Here

$$.48Y + (.70 \times 50) = .93Y + (.43 \times 50)$$

Then $.45Y = 13.5$
or $Y = 30$ tons per hr.

Incidentally, this problem is incapable of solution by arithmetic except by the very roundabout method of trial and error.

It will be observed in this case that the separator feed is a composite, consisting of 30 tons original feed carrying 48% 200 mesh, and 50 tons circulating load, carrying 70% 200 mesh, or a total feed of 80 tons carrying 49.4 tons of 200 mesh product, or 61.7% 200 mesh. Hence, $A = .617$, $B = .43$, and $C = .93$, from which $E = 56.4\%$.

As a check against our figures, the efficiency will also be computed by Formula (3)

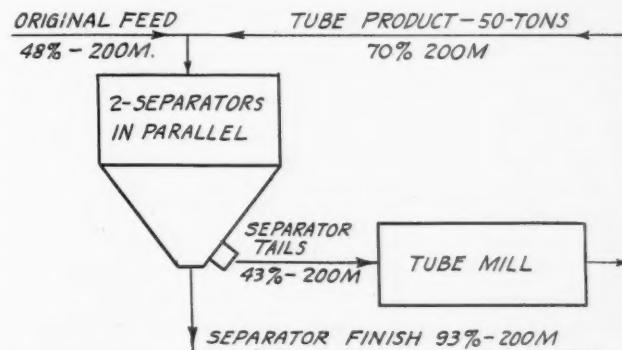
$$E = \frac{CY}{AX}$$

Substituting the known values in this formula, we have

$$E = \frac{.93 \times 30}{.617 \times 80} = 56.5\%$$

In connection with separator efficiency, an engineer writes saying that he is unable to reconcile the formula for efficiency given here with one appearing in a technical publication a number of years ago, ascribed to a well-known separator manufacturer and used also by a writer in *Chemistry and Industry*, October 8, 1926. (This was also published in *ROCK PRODUCTS*, November 12, 1927, in a series of articles by Edmund Shaw on air-separation methods.) The following is quoted from the article mentioned:

1. Take a definite quantity of the material fed to the separator. By screen analysis determine the percentage of material in this sample of the required fineness. Designate this percentage A . The balance of sample is



Flow Sheet 4—An example of two separators in parallel

tails or oversize, and designate this percentage B . Thus $A + B = 100\%$ of feed.

2. Take a definite quantity of the oversize or tailings discharged by the separator. By screen analysis determine the percentage of fines in this oversize, which should have

been removed by the separator. Designate this by C . The remainder is tails; designate this percentage as D . Thus, $C + D = 100\%$ of the tailings discharged.

"3. To ascertain separator efficiency, multiply the per cent. of tails in feed, B , by the per cent. of fines in tails, C , and divide the result by percentage of coarse in the

$$B \times C$$

tails, D , that is, $\frac{B \times C}{D}$. Subtract this figure from the percentage of fines in the feed, A , and divide by percentage of fines in feed A . Thus the formula becomes:

$$\text{Efficiency} = A - \frac{(B \times C)}{(D)}$$

"Supposing that $A = 80\%$, $B = 20\%$, $C = 10\%$ and $D = 90\%$, then substituting these values in the above equation, we have

$$\frac{20 \times 10}{90} = 2.22 \text{ and } 80 - 2.22 = 77.78.$$

Then $77.78 \div 80 = 97.22\%$ efficiency."

The foregoing formula, when rewritten to conform to the nomenclature employed in the present text, would read as follows:

$$E = \frac{(100 - A)B}{(100 - B)}$$

It would appear that since no value for C is given, C must be a constant, and to determine the value of C , the expression for efficiency developed in the present discussion will be equated against the value of E as computed, and we have

$$\frac{C(A - B)}{A(C - B)} = 97.22\%$$

Substituting known values for A and B , which are 80% and 10% respectively, the equation becomes

$$\frac{70C}{80(C - 10)} = 97.22$$

and in order to satisfy the equation C must equal 100% . In other words, the finished product from the separator must pass exactly 100% through the given mesh upon which the calculation is based. As this condition seldom if ever obtains in practice, the formula for efficiency as presented in the present article is recommended and, in fact, is now generally adopted.

The solution of a problem is shown by the following comparison of methods. Assume that a product from a separator is required to pass 90% through 200 mesh and that samples from the separator upon screening through a 200 mesh laboratory screen give the following results:

Separator feed, $A = 63\%$ passing 200 mesh
Separator tails, $B = 36\%$ passing 200 mesh
Separator finish, $C = 90\%$ passing 200 mesh

The efficiency of the separator according to the formula given in the present text is

$$E = \frac{.90 \times .27}{.63 \times .54} = 71.4\%$$

In order to determine efficiency by the second formula, we must first adjust the screen analyses by introducing a factor which will bring the value of C to unity. Consequently, in this case we divide by 90% expressed as a decimal. Performing this operation, we have,

$$A = \frac{63}{.90} = 70\%, \quad B = \frac{36}{.90} = 40\%,$$

$$C = \frac{90}{.90} = 100\%$$

Then following the procedure outlined by the author of the second formula we obtain:

$$A = 70, B = 30, C = 40, D = 60$$

from which we have

$$E = \frac{70 - \frac{40 \times 30}{60}}{70} = 71.4\%$$

These examples of dealing with separator formulas illustrate the ordinary problems encountered in separator work, and it is apparent that no particular skill is required in the application of the formulas, as they are extremely simple, yet they provide at once a means of eliminating guesswork and approximations. They will be found of particular value in the design of grinding plants in which grinding units are employed in closed circuit or where separating devices are to be used for the purpose of scalping mill feeds in ordinary open-circuit operation. They are of equal importance in checking the performance of existing separator installations where it is desired to determine accurately the results accomplished, or to forecast the results which may be anticipated from proposed changes in hook-up.

It may be mentioned in passing that errors either in screening samples or in recording the results of such screening may be readily detected by the application of formulas for computing loads or efficiencies at various points of the screen scale.

Cement Markets of Uruguay

AT A FEW INTERVALS over the past four years, foreign producers have been able to place cement on the Uruguayan market at a price competitive with the domestic industry, but for the most part imports have been made to supply the excess of demand over national production. For the past six months no foreign cement has entered Uruguay, due to the adverse exchange situation, except a small quantity from Russia.

Cement imports from the United States have dwindled from 29% of the total in 1927 to 12% in 1930, probably because the American cement could not compete in price with that from Europe. While there are no figures to determine the percentage of white to portland cement, it is authoritatively claimed that the greater portion of that coming from the

United States is white cement, with the exception of imports in 1927 and 1928, when the demand so exceeded the capacity of the national industry that it had to import American cement to meet requirements. White cement is imported in barrels of 170 kilos each, and most of the gray comes in heavy paper bags of from 42 to 44 kilos each.

The city of Montevideo consumes 73% of the total imports. Importers of foreign cement purchase for their own account and sell to smaller dealers. Imported white cement, also handled by importing firms and supplied to wholesalers, retails, in normal times, at 1.25 to 1.30 pesos per 50 kilos.

Cement imported from the United States is not competitive in price with European brands, but is generally considered of equal quality.

The local producers are not interested in export markets. European and American cements can be shipped to countries adjacent to Uruguay at a better price than can be quoted by the Uruguayan industry.

The prosperous condition of the Uruguayan cement industry, and the growing volume of imports through 1930, are the result of extensive private and governmental building programs, involving the use of cement. The national and municipal authorities in carrying out extensive programs of road building and street paving have stipulated concrete. It is estimated that during normal times about 1,000,000 square meters of concrete pavement is laid annually.

The above information is contained in Special Circular 13 issued by the minerals division of the Bureau of Foreign and Domestic Commerce.

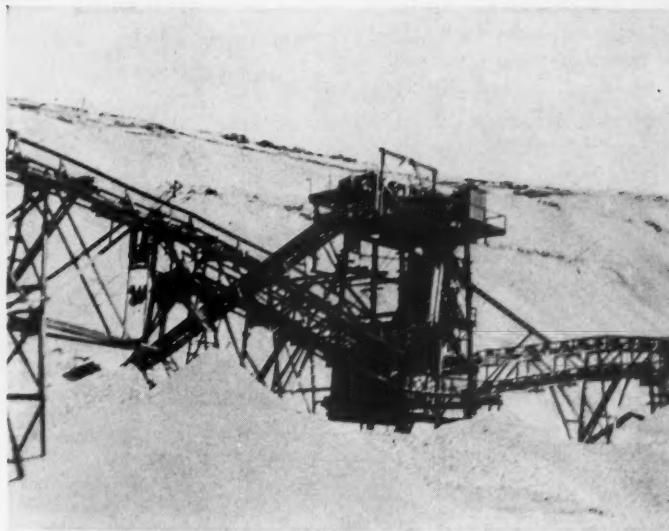
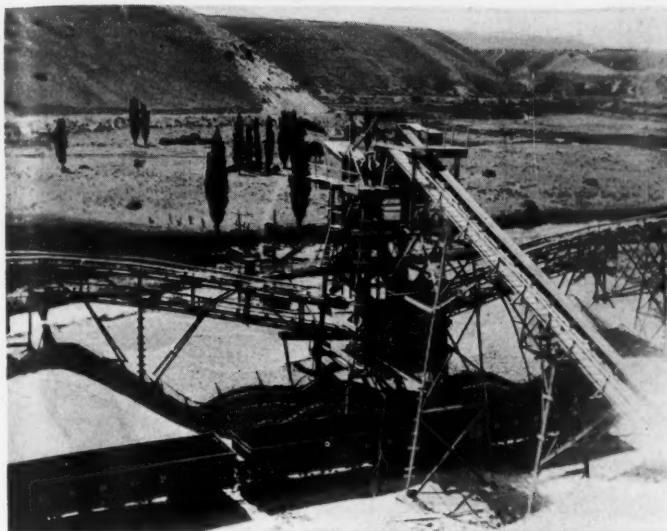
Plan Gravel Fill in Lake to Aid Employment

GRAVEL AND SAND for use in filling the Lake Monona shore of Olbrich park, Madison, Wis., will be purchased from the Robert Armstrong gravel pit on the Sun Prairie road, it is practically determined.

The money to start this project in motion will be raised by Madison theaters. The theaters expect to raise enough money to keep 100 men at work during the winter, each man working part time.

Mr. Armstrong, in a conference with Mayor Schmedeman, representatives of the Madison Park and Pleasure Drive Association, council outdoor relief committee, and the mayor's cabinet, offered to sell the city the gravel and sand at 2c per cu. yd. The city must do the loading, hauling and distribution. As many city trucks as possible will be used in the work.

City officials at the conference were favorable to the offer, claiming that by this low price a great deal more work can be done for the same amount of money.—*Madison (Wis.) Times*.



Two views of screening plant, from opposite sides

Sand and Gravel That Needs No Washing

Interesting Small Plant Operated by Salt Lake Valley Sand and Gravel Co., Salt Lake City, Utah

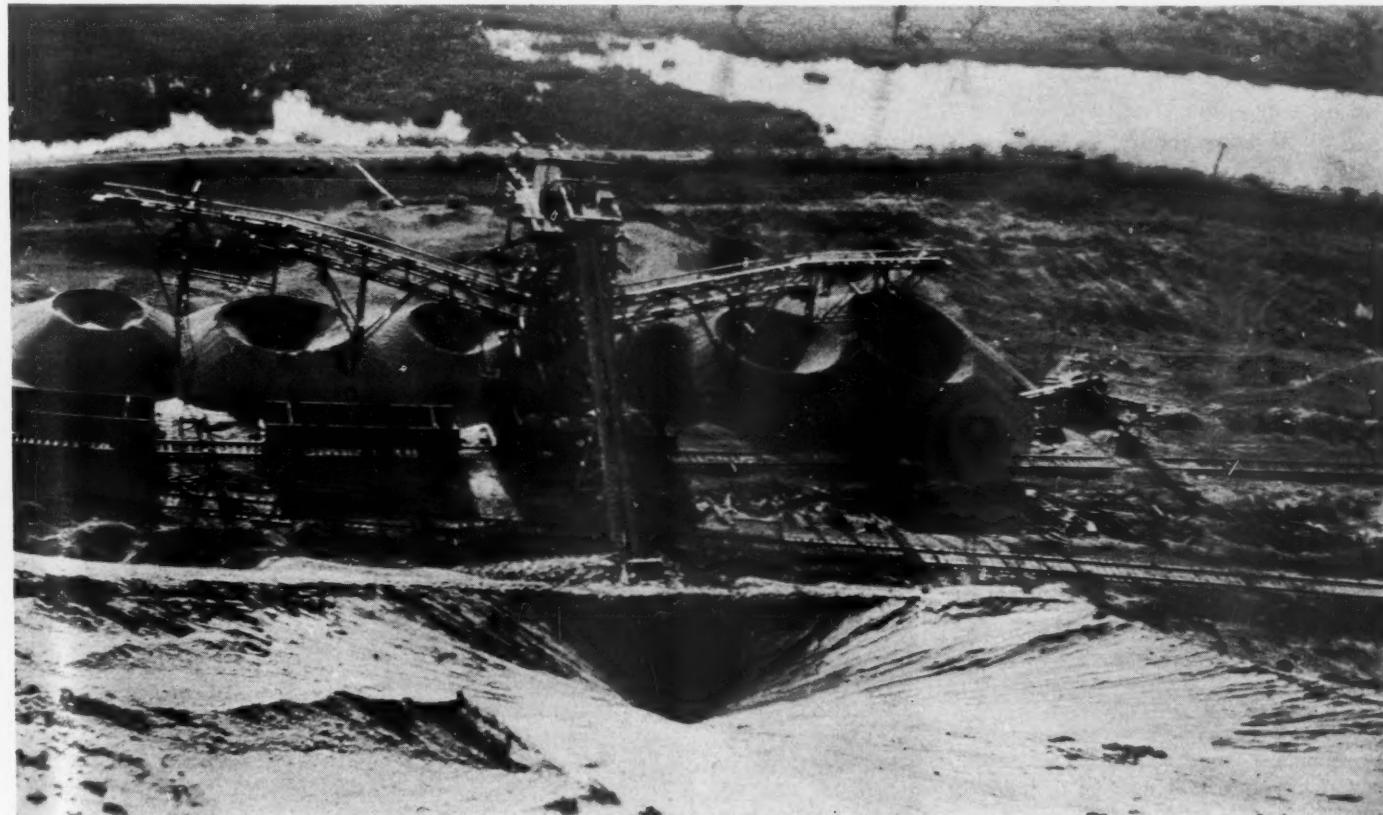
A FEW MILES south of Salt Lake City, Utah, and near the main highway to the south, an unusual sand and gravel deposit is being worked by the Salt Lake Valley Sand and Gravel Co.

The deposit consists of a large hill of

clean white sand and gravel which is free running and is unusual in that it does not require any washing. It runs about 50% gravel and 50% sand, with only a small amount of coarse or oversize material and some excess of pea gravel or $\frac{3}{8}$ -in. size. As

a result, no washing or crushing is necessary and the material is excavated and loaded with a minimum of equipment.

By using a glory hole method of excavating, the material is easily fed by gravity to an inclined belt conveyor tunneled into the

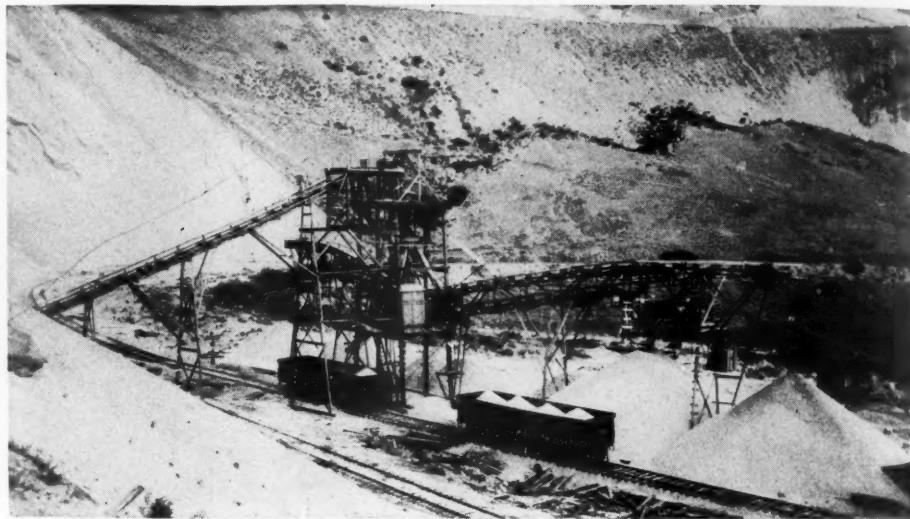


Looking down on stockpiles and screening plant

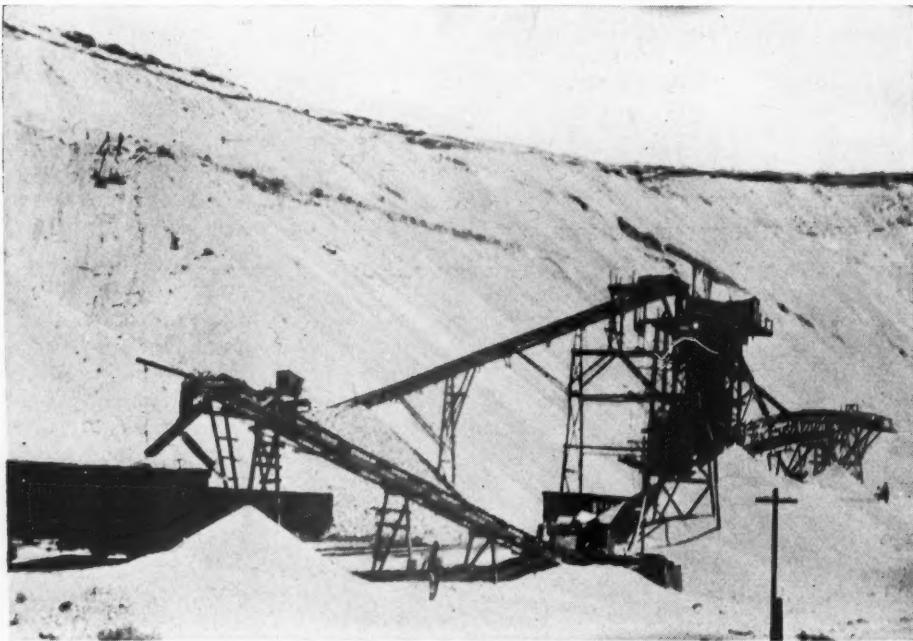
side of the deposit. The bank is about 300 ft. high and slopes back at the natural angle of repose of the dry material.

From the conveyor the material is discharged to a short revolving scalping screen from which the commercial sizes fall to a set of four inclined screens, one vibrating and three gravity, in series. The plant has no loading bins. The sized material is either spouted direct to a railway car or conveyed to separate stock piles. From these piles the different sizes are reclaimed and loaded to a railroad car by means of a belt conveyor located in a tunnel below the piles.

The inclined belt conveyor from the pit to the sizing plant is 22 in. wide by 125 ft. long on centers and extends down into a timber tunnel below the raw material. The tunnel



General view of plant



View showing reclaiming conveyor at left

extends down and back to a point some 15 ft. below the apex of the inverted cone of excavated material and can of course be extended when necessary in order to have a supply of free-running material above the feeding point.

Raw Material Feeder

A short belt conveyor feeder driven from the boot shaft of the main conveyor is used to feed the proper amount of raw material to the belt and also to insure against any overloading.

The main belt conveyor is driven by a 15-hp. motor through a Texrope drive. Scalping is done in a 42-in. by 10-ft. Allis-Chalmers revolving screen driven by a 10-hp. motor.

The oversize or plus 2½-in. material is spouted to one of the six storage piles above the reclaiming tunnel and loaded out to railroad cars as often as may be desirable or necessary.

The minus 2½-in. material is separated

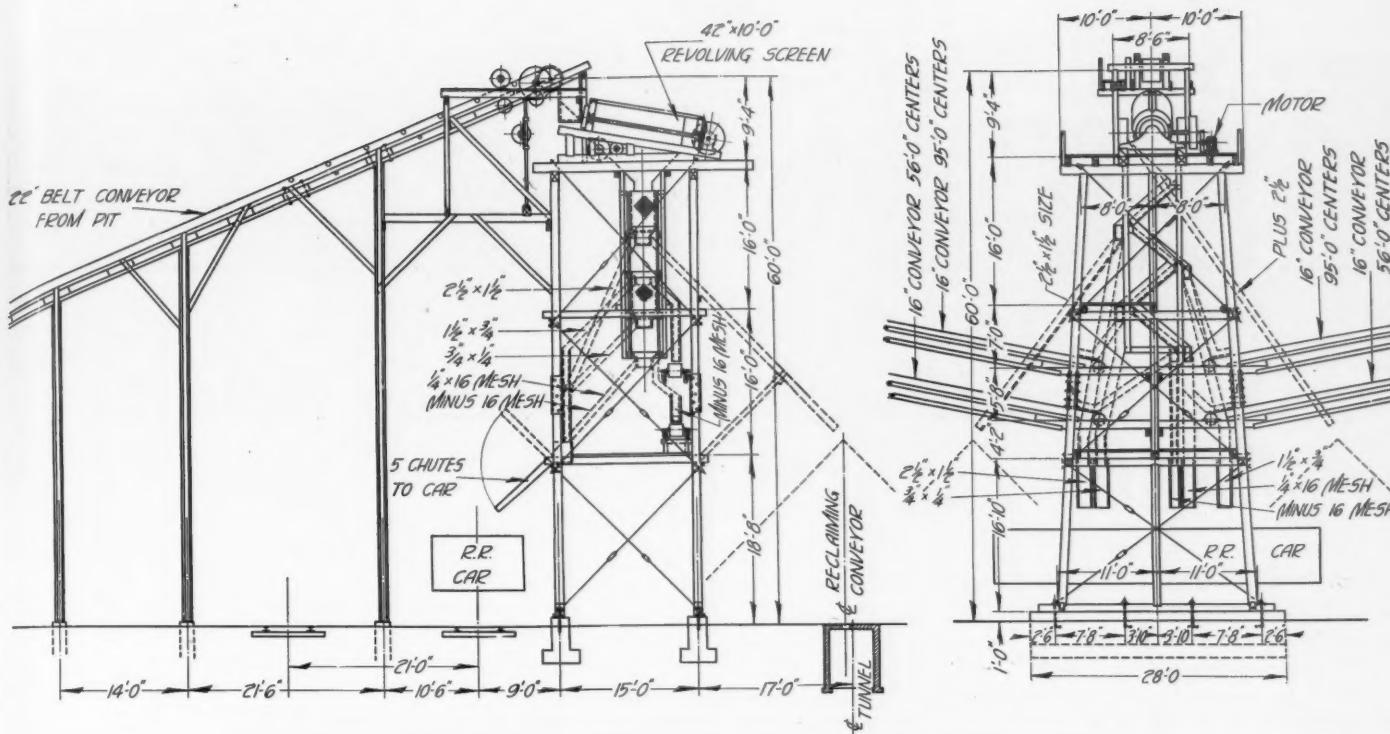
into five sizes over a set of four single-deck inclined screens which are arranged in series one below the other in zigzag fashion. One of these is a Universal vibrating screen and the other three are inclined gravity screens.

The different sizes are spouted either direct to the railroad car or are carried to the storage piles on four separate belt conveyors extending in both directions above the reclaiming tunnel. These conveyors are 16 in. wide and are supported on a timber framework. The two upper belts are each 95 ft. long and the two lower ones are 56 ft. long on centers. Each pair is driven by a 7½-hp. motor.

The reclaiming tunnel below the storage piles is of concrete and the balance of the plant is of timber construction. All motors are Allis-Chalmers with Texrope drives.



View of deposit and plant from highway



General arrangement of plant of Salt Lake Valley Sand and Gravel Co.

The plant is operated with a total of five men and has a capacity of 60 to 70 tons per hour. It is located at Nash, Utah, 22 mi. south of Salt Lake City, and was put into operation about two years ago.

The office of the company is in the Kearns Building, Salt Lake City. Frank M. Maher is president; J. J. Stewart, vice-president, and J. B. Maher, secretary-treasurer.

Cement Markets of Colombia

CEMENT manufactured in Colombia at present is considered of almost as good quality as that from the United States, although some consumers have claimed that it is variable and does not stand up so well as foreign cement in certain types of construction. It is generally expected that the tendency in Colombia will be to lessen imports of portland cement; that foreign cement will continue to meet the requirements of the cities along the coasts, but that interior cities may be supplied by domestic plants. Cement is subject to an import duty of \$0.01 per gross kilo in Colombia.

Import figures for 1928 are the latest now available, and show that Colombia's principal foreign suppliers of cement, in point of volume, were Denmark, Norway, Belgium, and the United States, and in value were Denmark, the United States, Belgium, and Germany.

In the reconstruction of the city of Buenaventura under the new urbanization plan, the building specifications will exact the use of Portland cement in practically all structures. Large quantities will also be made use of in street improvement work and for other purposes.

California's Mineral Industries in 1930

COMPILATION of the final returns from the mineral producers of California for 1930 by the statistical section of the State Division of Mines, under the direction of Walter W. Bradley, state mineralogist, shows the total value for the year to have been \$365,604,695, being a decrease of \$66,643,533 from the 1929 total of \$432,248,228. There were 51 different mineral substances, exclusive of a segregation of the various stones grouped under gems; all but one of the 58 counties of the state contributed to the list.

As revealed by the data following, the salient features of 1930 compared with the previous year were: A material decline in the amount and value of the petroleum output, with notable decreases in amounts and values of cement, natural gas, copper, miscellaneous stone, salt, brick and hollow building tile, and pottery clay. Increases were registered by gold, mineral water, borax, potash, quicksilver, lime and lead. Petroleum showed a decrease in value of \$49,667,817.

Of the structural materials, lime was the only important item to show an increase, which was from 42,834 tons worth \$417,101 to 47,662 tons worth \$452,084. Cement decreased from 12,794,729 bbl. worth \$21,038,565 to 9,831,938 bbl. worth \$14,575,731, brick and hollow building tile from a value of \$5,607,410 to \$4,205,460 and miscellaneous stone from \$17,840,159 to \$16,430,027. Of the industrial minerals, pumice and volcanic ash and fuller's earth showed small increases in their total values, with all materials, other than these, in the group showing decreases and a decrease in total value. Of

the saline group, borax showed increases from 144,687 tons worth \$3,312,085 to 209,869 tons worth \$3,686,817; potash also showed a marked increase, but not enough to offset the decrease in salt and other minerals in this group.

DISTRIBUTION OF THE 1930 OUTPUT OF CALIFORNIA BY SUBSTANCES

Substance	Amount, tons	Value
Barytes	19,783	\$ 133,107
Bituminous rock	8,525	36,075
Borates	209,869	3,686,817
Brick and hollow building tile		4,205,460
Cement	9,831,938*	14,575,731
Chromite	80	1,905
Clay (pottery)	938,586	795,517
Coal	10,885	59,858
Copper	26,534,752†	3,449,522
Dolomite	35,721	106,813
Feldspar	5,014	35,654
Fuller's earth	12,522	177,964
Gems		3,540
Gold		9,451,162
Granite		855,477
Gypsum	116,865	243,507
Lead	3,524,796	176,241
Lime	47,662	452,084
Limestone	169,477	508,751
Magnesite	38,681	388,472
Marble (onyx and travertine)		82,194
Mineral water	37,354,111‡	2,870,663
Natural gas	313,513,952§	24,559,840
Petroleum	227,328,988*	271,699,046
Platinum	217¶	11,700
Pumice and volcanic ash..	12,947	128,847
Pyrites	39,954	194,228
Quicksilver	11,374||	1,255,257
Salt	347,945	1,167,487
Sandstone		56,404
Silica	17,802	71,380
Silver	1,622,803||	624,779
Soapstone and talc	15,861	154,258
Soda	90,122	1,627,344
Stone, miscellaneous (a)		16,430,027
Unapportioned (b)		5,327,584
Total value.....		\$365,604,695

(a) Includes macadam, ballast, rubble, riprap, sand and gravel.

(b) Includes asbestos, bromine, calcium chloride, diatomaceous earth, iron ore, magnesium salts, manganese or mineral paint, potash, slate, sillimanite-andalusite-cyanite group, tube-mill pebbles, sulphur and tungsten, also paving blocks.

*Barrels. \$ Thousand cubic feet.

†Pounds.

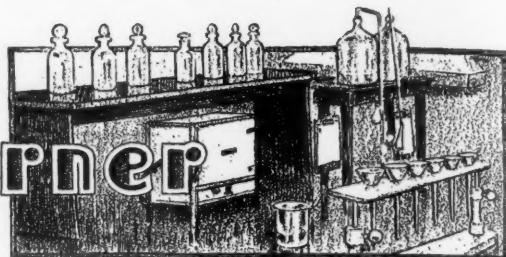
||Fine ounces.

‡Gallons.

¶Flasks.



The Chemists' Corner



Decomposition of Tricalcium Silicate

By E. T. Carlson

U. S. Bureau of Standards, Washington, D. C.

IT HAS LONG BEEN KNOWN that the prolonged calcination of portland cement results in a product having hydraulic properties inferior to those of a rapidly burned cement. An explanation of this phenomenon was given by E. Leduc¹ in 1901, following some experiments on the liberation of lime from cements on calcination at 1000 deg. C.² for various periods of time. The lime liberated, determined by dissolving it out of the cement with sugar solution, was found to increase with the length of time of heating, reaching a maximum at 48 hr. Leduc attributed the unsoundness of these cements to the free lime present.

The more recent work of S. L. Meyers³ showed that freshly burned cements break down much less readily than those which have been aged for some time. Meyers also experimented with the compounds $3\text{CaO}\cdot\text{SiO}_2$, $2\text{CaO}\cdot\text{SiO}_2$, $3\text{CaO}\cdot\text{Al}_2\text{O}_5$ and $4\text{CaO}\cdot\text{Al}_2\text{O}_5\cdot\text{Fe}_2\text{O}_3$, the chief constituents of portland cement. Of these, only the first was found to liberate lime on heating. These results were confirmed by W. Lerch.⁴

The present study was undertaken in order to determine the conditions affecting the decomposition of tricalcium silicate.

Preparation of Material

Sample No. 1 was prepared according to the method repeatedly described in previous publications of this bureau.⁵ A petrographic examination of the product showed that it consisted almost entirely of tricalcium silicate, with a trace of dicalcium silicate. The free lime content, as determined by the ammonium acetate method, was 0.35%. The material was kept in a glass-stoppered bottle.

¹ E. Leduc, "Notes on the Dissociation of Hydraulic Products"; International Association for Testing Materials, 3 (1901).

² All temperatures are expressed in degrees Centigrade.

³ S. L. Meyers, "Breaking Down of Tricalcium Silicate by Heat"; ROCK PRODUCTS, April 12, 1930.

⁴ Unpublished report.

⁵ Hansen, "Further Studies on Portland Cement Compounds by the X-ray Diffraction Method"; J. Am. Ceram. Soc., 11, (2), 68-78 (1928).

Samples Nos. 2, 3, 4 and 5 were prepared in substantially the same manner. Nos. 2 and 3 were burned several months before this study was begun, and Nos. 4 and 5 were about three years old. Petrographic examination revealed the fact that the grains of these samples had been altered superficially, giving them a mottled appearance, this being more noticeable in the older samples. The altered surface layer was too thin to permit a determination of its optical properties. Since these samples had been kept in loosely stoppered bottles, it was assumed that the alteration was due to the action of moisture or carbon dioxide in the air.

Determining Extent of Decomposition

A sample of the silicate (1 or 2 grams) was placed in a platinum thimble, which was suspended in a platinum resistance furnace and heated for a definite length of time, the temperature being kept constant to within ± 10 deg. Due to fluctuations in the line voltage, closer temperature control was impossible when samples were left in the furnace over night. Temperatures were measured by means of a platinum-platinum-rhodium thermocouple and a potentiometer. After removal from the furnace, the sample was allowed to cool in air, and the free lime was determined at once by the ammonium acetate method.⁶ In the later experiments this method was modified by the substitution of phenol red for phenolphthalein as indicator, the former being more satisfactory because it does not fade in alcoholic solution.

Effect of Age of Sample

As mentioned above, previous investigators have shown that the amount of lime liberated on heating a cement is dependent to some extent on the age of the sample. That this is also true of tricalcium silicate is shown in Table I, which gives a comparison of the various samples used in this study.

⁶ Lerch and Bogue, "Revised Procedure for the Determination of Uncombined Lime in Portland Cement"; Ind. Eng. Chem., Anal. Ed., 2, 296 (1930).

TABLE I. EFFECT OF AGE OF SAMPLE ON THE DECOMPOSITION OF TRICALCIMUM SILICATE BY HEAT

Sample No.	Age of sample	Temp., deg. C.	Time of heating, hrs.	Free CaO before heating, %	Free CaO after heating, %
1	1 day	1150	23	0.4	1.0
2	About 1 year	1175	---	0.0	14.1
3	Several months	1150	---	0.2	15.2
4	3 years	1150	---	0.0	17.5
5	3 years	1150	---	0.0	18.2

It will be seen that the tendency to dissociate is much less in the case of the fresh material. In view of this fact, it was thought that perhaps the stability of the old samples could be renewed by heating them to higher temperatures. Table II gives the results of some experiments which showed this to be the case.

TABLE II. EFFECT OF PRELIMINARY HEATING AT HIGHER TEMPERATURES

Sample No.	Heat treatment	Free CaO after heating, per cent.
2	Held 23 hr. at 1175 deg. C. (Table I)	14.1
2	Heated to 1450 deg. C.; cooled to 1150 deg. C. and held 24 hr.	3.9
2	Held 17 hr. at 1325 deg. C.; cooled to 1175 deg. C. and held 24 hr.	0.85
2	Held 3 hr. at 1400 deg. C.; cooled to 1175 deg. C. and held 17 hr.	0.27
2	Held 3 hr. at 1400 deg. C.; cooled to room temperature; held 17 hr. at 1175 deg. C.	0.10

It is evident that the condition responsible for the rapid breakdown of the silicate may be removed by prolonged heating at temperatures of 1325 deg. C. or higher.

Effect of Temperature

In order to determine the temperature at which the amount of decomposition reached a maximum, samples of the silicate were held at various temperatures (± 10 deg.) for 23 hr., and then cooled quickly and tested for free lime. The 23-hr. heating period was chosen merely for convenience, as this made it possible to make a determination every day. Table III gives the results obtained.

Rock Products

TABLE III. DECOMPOSITION OF $3\text{CaO}\cdot\text{SiO}_3$ ON HEATING FOR 23 HOURS AT VARIOUS TEMPERATURES

Temperature* Deg. C. ± 10	Free CaO after heating, per cent. Sample No. 2	Free CaO after heating, per cent. Sample No. 3
1000	1.3	
1050	2.1	
1075	6.6	
1100	11.0	
1125	12.3	
1150	15.2	
1175	14.1	14.4
1200	14.9	
1225	12.2	
1250	8.1	10.6
1275	1.6	
1300	0.2	
1325	0.16	
1350	0.00	

*The temperatures for Sample No. 2 were measured with a millivoltmeter, possibly introducing a slight error.

These values are plotted in Fig. 1. It should be borne in mind that the points do not represent equilibrium conditions, but merely the extent to which the reaction had progressed in 23 hr., consequently the scattering of the points is not surprising. In view of this fact the single curve drawn probably approximates the correct curve for both samples. It will be seen that the amount decomposed attains a maximum at about 1175 deg. C.

Increase in Decomposition with Time of Heating

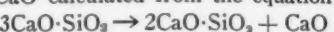
Table IV and Fig. 2 show the change in the extent of the decomposition with time at three different temperatures. Sample No. 4 was used for these experiments.

TABLE IV. AMOUNT OF DECOMPOSITION OF $3\text{CaO}\cdot\text{SiO}_3$ AT DIFFERENT TEMPERATURES

Temperature, Deg. C. ± 10	Length of heating hours	Free CaO, per cent.
1150	1	4.7
1150	2	6.2
1150	3	7.8
1150	7	11.6
1150	17	15.2
1150	23	17.5
1150	53	18.9
1200	1	3.2
1200	2	4.4
1200	16	11.3
1250	1	0.9
1250	2	1.2
1250	5	1.8
1250	16	3.8
1250	23	10.6
1250	24	2.7
1250	25	8.7
1250	48	5.8

It will be noted that the results obtained on heating the samples to 1250 deg. C. are decidedly inconsistent, although at 1150 deg. C. the points lie very nearly on a smooth curve. This is perhaps to be expected, since the rate of the reaction decreases rapidly with increase in temperature in the region of 1250 deg. C. As can readily be seen from Fig. 1, a difference of ± 10 deg. C. in temperature could account for wide variations in the amount of decomposition. Such changes of temperature were unavoidable when the samples were left in the furnace over night, due to fluctuations in the line voltage.

From the shape of the curves it appears that the free CaO content approaches a maximum value which is different for different temperatures. The theoretical amount of free CaO calculated from the equation



on the assumption that it goes to completion, is 24.57%, which is considerably in excess of any of the experimental values obtained.

Effect of Moisture

Since it was evident that the stability of $3\text{CaO}\cdot\text{SiO}_3$ is affected by exposure to air,

it is evident from these data that moisture has a great effect on the stability of tricalcium silicate. Although the products of the hydration of tricalcium silicate on the addition of water are not yet known with certainty, it is known that calcium hydroxide is formed and that a gelatinous substance remains, which is very probably a hydrated calcium silicate.

Both calcium carbonate and hydrated silica decompose quite rapidly at 1100 deg. C.; hence, it was argued that ignition of the exposed silicate for 20 min. over a Fisher

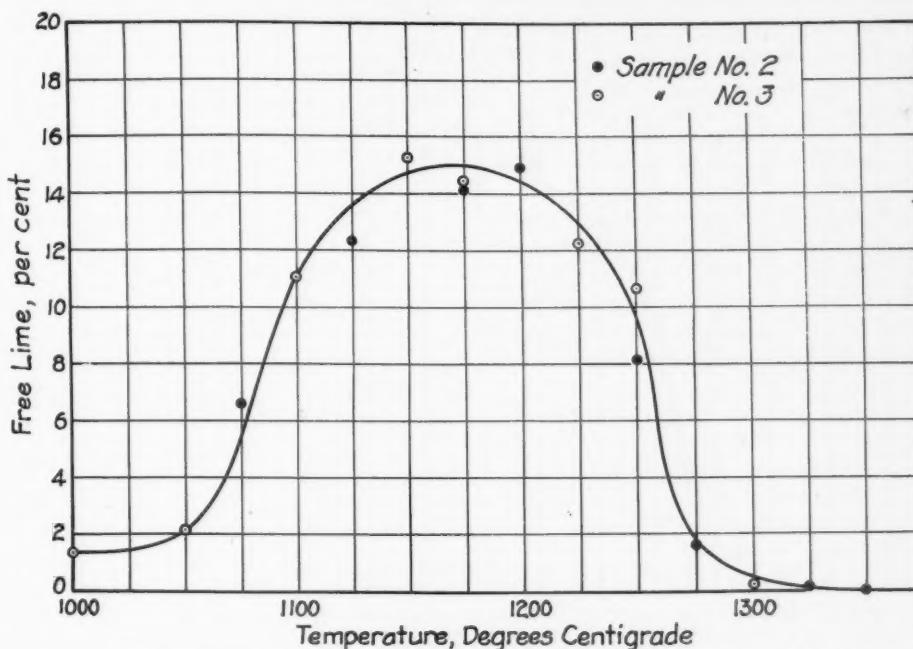


Fig. 1. Decomposition of tricalcium silicate on heating for 23 hr. at various temperatures

it was decided to ascertain, if possible, any existing quantitative relation between the ignition loss of the material and its decomposition by heat. The action of the air was accelerated by placing some of the silicate (Sample No. 1) in an evaporating dish which was then placed in a larger dish containing a little water and covered with a watch glass. In this way the material was exposed to a rather humid atmosphere. No attempt was made to exclude carbon dioxide. Samples were removed from time to time, and the loss on ignition determined, after which they were heated for 23 hours at 1150 deg. C. and tested for free lime. Results are shown in Table V and Fig. 3.

TABLE V. DECOMPOSITION OF $3\text{CaO}\cdot\text{SiO}_3$ AS A FUNCTION OF THE IGNITION LOSS

Ignition loss, per cent.	Free CaO after heating, per cent.
0.23	0.6
0.41	1.2
0.47	1.5
0.51	2.6
0.54	2.2
0.60	2.2
0.73	3.5
1.34	6.1
1.70	8.8
1.96	8.0
2.52	11.4
5.02	14.4
7.00	16.8

burner (Meker type) would remove all but traces of water and carbon dioxide, at the same time liberating the lime which was present as either the hydroxide or the carbonate. Two samples of the silicate were exposed to moist air for different lengths of time, then ignited for 20 min. over a Fisher burner. After the ignition loss was determined, the samples were tested for free lime without further heating, while a portion was held at 1150 deg. C. for 23 hrs. and then tested. The results are given in Table VI.

TABLE VI. LIME LIBERATED ON IGNITION OF EXPOSED TRICALCIUM SILICATE

Ignition loss, per cent.	Free CaO after heating 23 hrs. at 1150 deg. C., per cent.
4.64	4.5
5.02	3.1

*Estimated from Figure 3.

The data clearly show that the amount of lime liberated on heating for 23 hours is much greater than that produced by a hydroxide through exposure to moist air.

In an attempt to determine the nature of these changes, petrographic and X-ray studies were made of the silicate after exposure to moist air, after brief ignition, and

after prolonged heating at 1150 deg. C. Under the microscope, the appearance of the exposed material was similar to that of Samples 2, 3, 4 and 5, previously described. The grains appeared to be mottled on the surface, the altered layer being either isotropic or too thin to show interference. The X-ray powder diffraction pattern was exactly like that of the unexposed silicate (Sample 1). After ignition two new faint lines appeared, corresponding to lines on the pattern for CaO. After prolonged heating, a new series of lines, corresponding to the pattern for β -2CaO·SiO₂, were found superimposed upon the regular 3CaO·SiO₂ series, and the lines due to CaO were strengthened. Grains of dicalcium silicate were also visible under the microscope. These results indicate that the products of the decomposition of tricalcium silicate are dicalcium silicate and lime.

It is evident that the extent of the decomposition on prolonged heating is much greater than can be accounted for on the assumption that all the free lime comes from the calcium hydroxide or calcium carbonate which has been formed by the action of the air.

In order to determine the effect of free CaO on the stability of the silicate, portions of Sample 1 were thoroughly mixed with small amounts of CaO or Ca(OH)₂, and the free lime determined after 23 hours' heating at 1150 deg. C. In all cases there was a marked increase in the free lime content, indicating that the presence of CaO accelerates the decomposition. Since CaO has this effect, it might be expected that the other product of the decomposition, dicalcium silicate, would act in a similar manner. Experiments showed that this was indeed the case. Five per cent. of gamma-dicalcium silicate mixed with a portion of tricalcium silicate (Sample 1) caused it to decompose, yielding 5.8% free CaO after 23 hours' heating at 1150 deg. C. It should be noted that the gamma-form of dicalcium silicate inverts to the beta-modification far below the temperature used, so the latter was the form in contact with the tricalcium silicate.

These results were verified by experiments on Sample 4. As this was one of the "weathered" samples, it was first renewed by heating to 1425 deg. C. The data obtained are shown in Table VII.

TABLE VII. EFFECT OF PRESENCE OF CaO AND 2CaO·SiO₂ ON THE DECOMPOSITION OF 3CaO·SiO₂

(All samples heated 23 hr. at 1150 deg. C.)

Sample No.	Material added	Free CaO after heating, per cent.	Free CaO in excess of that added, per cent.
1	None	0.4	0.4
1	10% CaO	15.3	5.3
1	5% CaO	11.5	6.5
1	Ca(OH) ₂ equivalent to 5% CaO	12.9	7.9
1	2% CaO	6.8	4.8
1	5% 2CaO·SiO ₂	5.8	5.8
4*	None	1.4	1.4
4*	5% CaO	15.3	10.3
4*	5% 2CaO·SiO ₂	7.1	7.1

(Renewed).

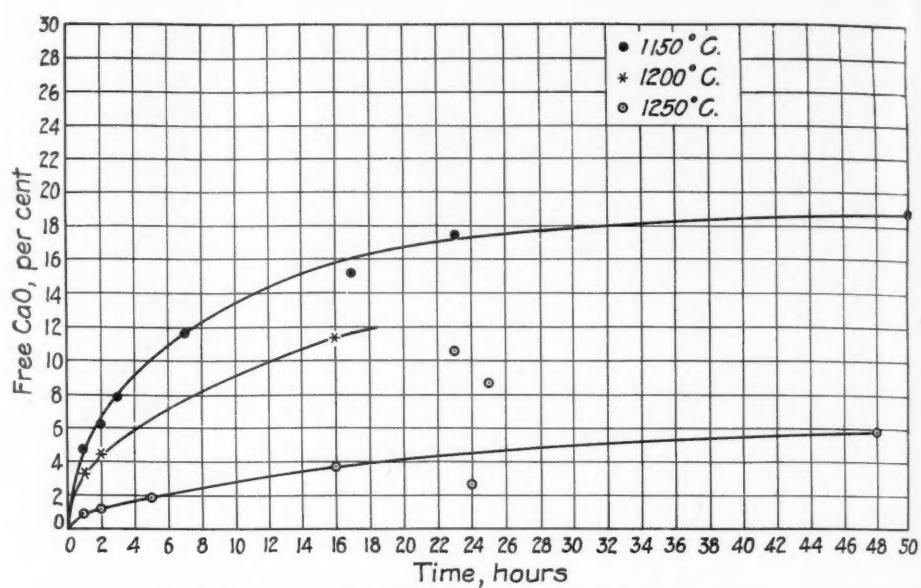


Fig. 2. Rate of decomposition of tricalcium silicate

Catalytic Effect of Gypsum

Although Meyers stated that the presence or absence of gypsum in cement had no effect on the liberation of lime, the later work of Mullan⁷ seems to indicate that gypsum tends to accelerate the reaction.

In the present study, samples of tricalcium silicate were mixed with small amounts of gypsum and heated in the manner previously described. In all cases the liberation of lime was very marked. It was thought that this might be due to the decomposition of the calcium sulfate and the catalytic effect of the lime liberated. Accordingly, a sample of gypsum was heated in the same manner and tested for free lime, but the decomposition was found to be rather slight. However, it is possible that this reaction proceeds more rapidly in the presence of tricalcium-

silicate. A mixture of the two substances showed a decrease in the SO₃ content after heating, indicating that this is actually the case. In this connection it is interesting to note that other investigators have found the decomposition temperature of calcium sulfate to be lowered by the presence of silica. Cobb⁸ states that the decomposition of CaSO₄ becomes appreciable at 1225-30 deg. C. normally, but starts at 1005-10 deg. C. when the sulfate is mixed with SiO₂.

It should be noted, however, that the presence of gypsum is not essential to the process of decomposition, as the samples previously described were shown by analysis to be free of SO₃.

The above results are summarized in Table VIII.

⁷ T. F. Mullan, "Effect of Gypsum on the Decomposition of Tricalcium Silicate by Heat"; ROCK PRODUCTS, August 30, 1930.

⁸ J. W. Cobb, "The Synthesis of a Glaze, Glass, or Other Complex Silicate"; J. Soc. Chem. Ind., 29, 69-74 (1910).

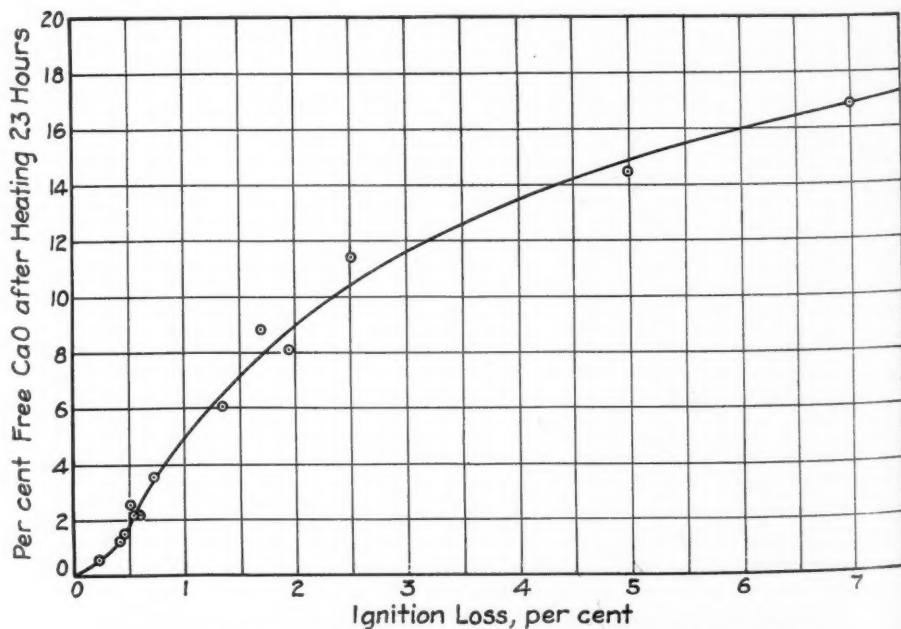


Fig. 3. Effect of moisture on decomposition of tricalcium silicate

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TABLE VIII. EFFECT OF GYPSUM ON THE DECOMPOSITION OF TRICALCUM SILICATE

Sample No.	Material added	Free CaO		SO ₃ lost, per cent.
		after heating, per cent.	SO ₃ after heating, per cent.	
1	5% gypsum	10.0	.....	.....
1	5% gypsum	1.87	0.46	.....
1	5% anhydrite	11.4	.....	.....
4*	5% gypsum	17.5	.....	.....
None	Gypsum alone	0.32	.....	.....

*(Renewed).

Discussion

From the foregoing results it is possible to obtain some insight into the mechanism of the decomposition. It seems evident that tricalcium silicate is in a metastable state at temperatures below 1300 deg. C. It is known that between 1400 and 1900 deg. C. the reaction



takes place, though it proceeds rather slowly at 1400 deg.. This, in fact, is the method used in preparing tricalcium silicate. It has been shown by Rankin⁹ that at temperatures above 1900 deg. C. the reaction proceeds in the opposite direction. The results of the above experiments indicate that the reaction also tends to proceed in the reverse direction at temperatures below 1300 deg. C., but that the presence of at least one of the products of the reaction is necessary to start the decomposition. It is probable that the reaction takes place only at points of contact between particles of tricalcium silicate and one of the other two phases. A reaction of this type would be analogous to the crystallization from a supercooled liquid on "seeding," but it must be remembered that in the case under consideration all three phases are solid, and the reaction is necessarily slow. As even the purest samples prepared contained traces of CaO and 2CaO·SiO₂, these particles naturally acted as centers of reaction, resulting in a slight decomposition. When either of the two products was thoroughly mixed with the tricalcium silicate, the centers of the reaction were much more numerous, resulting in a greater rate of decomposition.

If this explanation is accepted, the role of "aging" becomes clear. The moisture of the air reacts with the silicate, liberating hydrated lime, which soon carbonates. When the material is then heated, CaO is obtained, and the grains of this material catalyze the further decomposition of the silicate. It is possible that 2CaO·SiO₂ is also formed when the "aged" silicate is heated, and that this also has a catalytic effect. If this material is then heated to 1400 deg. C., the dicalcium silicate and lime, already in close contact, reunite to form tricalcium silicate, which then shows the characteristics of the freshly prepared material.

From the curves in Fig. 2 it seems probable that the decomposition reaches a maximum value which varies with temperature. At 1175 deg. C. the tendency to dissociate

reaches a maximum, while at 1300 deg. and above, the tendency for the lime and dicalcium silicate to recombine is predominant. The existence of any definite equilibrium has not been determined, since to do so would require the maintenance of constant temperatures very accurately over a period of several days, perhaps weeks, especially at temperatures below 1150 deg. It should be noted that the curves in Fig. 1 do not necessarily indicate a tendency toward recombination at temperatures below 1150 deg. The falling off of the curves at these lower temperatures is more probably due to a slower speed of reaction.

Although the role of gypsum as a catalyst for the reaction has not been definitely established in this study, it seems probable that its action is caused by the lime liberated from the calcium sulfate on heating.

The writer is indebted to P. H. Bates and L. S. Wells for their many helpful suggestions and to H. Insley for his assistance with the petrographic and X-ray study.

Summary

1. Tricalcium silicate tends to dissociate into dicalcium silicate and lime when heated to temperatures between 1000 and 1300 deg. C.
2. The amount of decomposition reaches a maximum at about 1175 deg. C., being about 15 times as great at this temperature as at 1000 deg., after a day's heating.
3. The reaction is accelerated by the presence of either of the products of decomposition, dicalcium silicate and free lime.
4. Tricalcium silicate which has been exposed to moist air decomposes much more readily than when freshly burned, probably due to the presence of lime liberated by the action of moisture on the silicate.
5. The presence of gypsum also accelerates the decomposition. This may be due to lime liberated by dissociation of the gypsum.

Gypsum, Lime and Alabastine, Ltd., Starts Production on Three New Materials

IN ORDER to start production of three new building materials, additional labor has been provided within the past few days at the Caledonia plant of Gypsum Lime and Alabastine, Canada, Ltd. Plans are complete to process the new products in addition, at Montreal, and after that in western Canada plants.

All three products are the result of industrial research on which the company has been concentrating.

Two are sound-absorbing materials intended to correct acoustic conditions; the third is an insulating material involving new structural principles. Installations of all three in Canadian buildings have been arranged. Announcements of the products will reach the trade, it is expected, within 30 days. In the meantime plant production starts.—*Toronto (Ont.) Star.*

Seattle Chamber of Commerce Suggests Ways to Stimulate Building Activity

ACTIVE EFFORTS to stimulate reasonable new building projects and promote repairs and renovations while building prices are low will be undertaken by the Seattle, Wash., Chamber of Commerce through its committee on improved employment as a result of suggestions made by building industry leaders recently, with a view to increasing local employment.

The meeting was called to obtain from the builders themselves practical ideas as to what the chamber can do to assist their industry in the present situation.

Outstanding proposals made by the builders as means of increasing building activities were:

1—That arrangements be made whereby newly completed building projects may not be assessed for taxes immediately.

2—Formation among service clubs and other organizations of a "Two Days a Month Club," composed of persons agreeing to give work for two days a month in repairing and improving houses and buildings.

3—That a canvass of architects be made to find whether building jobs which have been delayed without good reason cannot be started immediately to give work.

4—That every possible means of acquainting the public with present low building costs be resorted to, including advertising, talks at clubs and by direct calls on house-owners.

5—That home owners, unable to afford hiring men to make repairs be encouraged to buy materials themselves and make their own repairs.

6—That dealers in building materials, such as lumber, be encouraged to point out to customers or prospective customers, the present low cost of such materials, as compared with those of a year or two ago.—*Seattle (Wash.) Journal of Commerce.*

Report Proposed Action Against Administration of County Gravel Funds

RUMORS of civil suits to collect money paid out for gravel in Delaware county, Ind., and other legal and official probes were reported at Muncie recently.

It was learned that three automobiles filled with prominent farmers of the county, headed by two Muncie attorneys, were making an inspection tour of the county's gravel piles.

It was at the same time reported that the first visit of the tourists would be to the county's gravel pile over in Madison county. This particular pile has brought about any number of discussions and disagreements over its location and in particular the buying of gravel in one county for use in another.

Road district 7, otherwise Mt. Pleasant township, was also to be visited during the course of the day. The attempted buying of more gravel in that district was abruptly halted when the bids were protested.—*Muncie (Ind.) Press.*

⁹ Rankin and Wright, "The Ternary System CaO-Al₂O₃-SiO₂"; *Am. J. Sci.*, 39, 1-79 (1915).



Hints and Helps for Superintendents

Car Dumping

RECENTLY the Catsman Sand and Gravel Co., Holley, Mich., changed from overhead electric trolley haulage to gasoline power and installed a Plymouth locomotive for the work. Cars of the 5-yd. Western type are used. These are dumped



Rail at base of car body rides over tripper at right, dumping car

at the track hopper serving the plant by a novel device that eliminates the need of a laborer at this place in the plant.

Alongside the track hopper a steel rail has been bent to form crudely the arc of a circle, and of sufficient height that when the train of three cars passes this point the body of each car is in turn raised sufficiently to throw the load off center so that the car dumps itself. After the cars are dumped the train proceeds toward the pit with the cars still in the dumped position until they are well clear of the plant, when in passing over a certain section of the track the cars assume their loading position. The track at this point has one rail a few inches lower than the other, so that the center of gravity of the car body is toward the normal loading position.

While this stunt is not exactly new, as we have published descriptions of similar devices in the past, yet it is surprising that few plants using a haulage system similar to this one have adopted automatic unloading devices.

No chain or other device is used on the rear or dumping side of the car, nor is there any special device at the pit to insure against accidental dumping of the car while loading. The only precautions are that the operator of the Lorain 75, the loading shovel in use, dumps his load in the center of the car, which apparently the operator has trained himself to do, for little or no trouble was said to be experienced from premature dumping.

Pipe Connections for Large Diameter Pipes

THE PIPE CONNECTION shown in the illustration is a patented device but is so serviceable and of such utility that we call it to the operators' attention.

If it should be necessary to cut out or join two pieces of pipe of comparatively large diameter, the connection can be applied without having to thread the pipe ends or remove the pipe joints from their location. Simply raise the pipe ends sufficiently to slip the collars and short intermediate sleeve over the pipe ends, insert the four bolts and tighten the nuts.

The two collars are provided with a specially designed rubber container that seals off all liquid or gas leakage. The connectors are made by the Dayton Pipe Coupling Co. and the picture shown above at the right shows an installation of this connection at the crushing plant of the Whiterock Quarries, near Bellefonte, Penn.

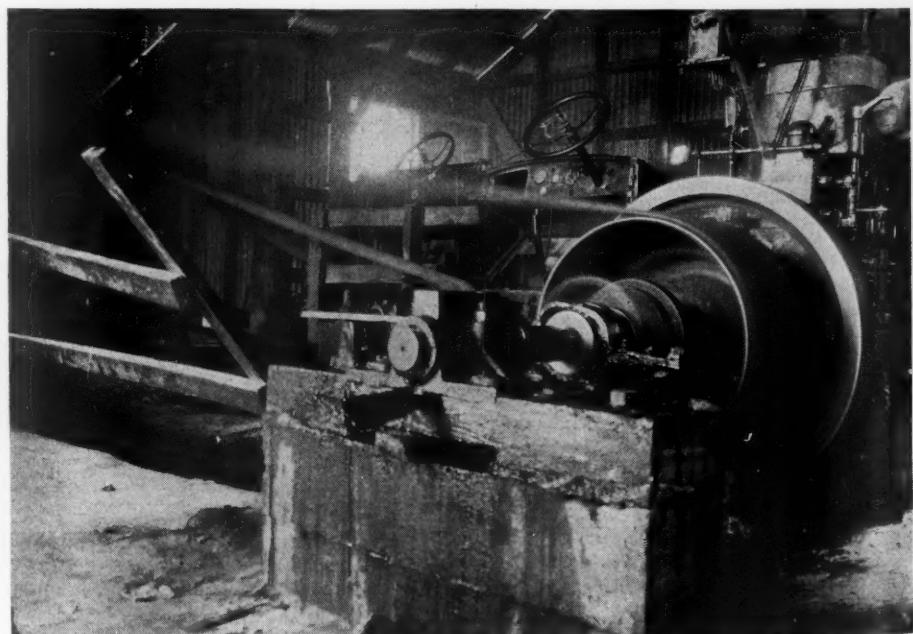


Rubber retainers on collars stop leakage

A Cheap Power Plant Investment

THE PUSLINCH PLANT of the Canada Crushed Stone Co., Ltd., is a small operation that was taken over by its present owners with the idea of supplying flux stone for the steel furnaces at Hamilton. The daily tonnage is not large and hence the plant investments, in order to show a profit at all, have had to be kept down to a minimum; consequently until the construction of electric power lines in the district, the plant, churn drill and quarry dewatering pump have been run by gasoline engines salvaged from an automobile and marine junk yard.

The plant itself is driven from a line shaft by three different gasoline engines, all belted direct to the one line shaft. The main engine here is a 4-cylinder, Automatic Machine



Three gasoline engines, all belted direct to one line shaft, drive the plant

Co., marine engine that was salvaged from a launch, and two engines salvaged from old Hudson automobiles. The Cyclone churn drill is driven by a fourth gasoline engine of an old Buick, and likewise the centrifugal pump used for clearing water from the quarry is driven by a second-hand automobile engine.

John Stephens, general superintendent for the Canada Crushed Stone Co., Ltd., and the man responsible for the novel engine installation, says that each engine cost about \$35.

Bucket Dump of Novel Construction

THE BUCKET DUMP shown in the accompanying illustration was developed by W. J. Loring, general manager of Hammon Copper at Kirkland, Ariz., and is described in *Engineering and Mining Journal*. Mr. Loring has had a 1-ton bucket of this type in continuous use since June, 1928. Larger buckets may be used if desired, in vertical as well as in inclined shafts. No

repairs have been necessary since the bucket was installed, and no extra labor is required, as the operation is controlled by the hoistman. It has all the advantages of the old crosshead unit, allowing free passage of the bucket should the crosshead become lodged in the shaft.

A U-bearing and a flange hold the bucket in a rigid position, keeping it from swinging and turning in the shaft making the hoisting of men safer. Passage of air from the shaft is not prevented, a common fault of most dumps, and the bucket is almost as steady in the shaft as a skip running on guides. Perfect safety in dumping is provided, as the door to which the dumping irons are attached serves as a chute for the dumped material. The axle, of 2-in. iron, is bolted to the bottom of the bucket 4 in. from the center line. In the illustration the bucket is shown landed in the chairs; a dotted outline indicates its position during dumping. After being dumped, the bucket is raised to clear the door, which is brought into a vertical position either by an air cylinder or a rope operated by the hoistman.



The churn drill and quarry pump are each driven by Buick engines

Oxygen Cylinder Carrier

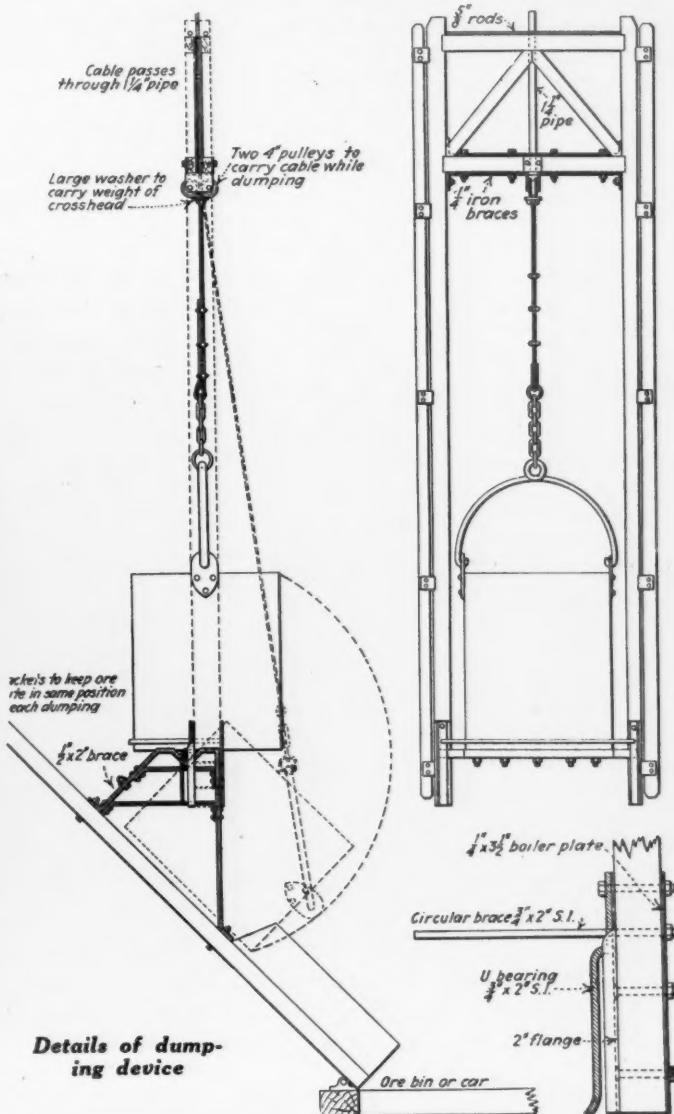
THE ADVANTAGES of having a portable oxygen-acetylene welding outfit are apparent to all quarry men who have had



This oxygen cylinder is moved quickly and easily

occasion to rush the apparatus out to the shovel or up on the quarry rim to repair a broken churn drill.

The illustration shows how the crew at the Steelton plant of the Bethlehem Mines Corp. keeps its welding outfit ready for an emergency call.



Rock Products Clinic

Concrete Evidence

THE EDITOR: For a number of years I have been absorbing data on aggregates, cement, concrete and methods, when it occurred to me that I had been identified with concrete construction for some thirty-five years. This fact brought to mind the earlier methods of construction and I fell to comparing them with the present day operations.

My first actual contact with concrete was the building of a large reservoir. The only available water was a mile distant and to obtain a supply for the job we constructed a ditch and ran the water by gravity to a dug pool near the reservoir site.

Aggregates were plentiful: A man with a team hitched to a wagon on which rested a box constructed of 2x4's for the floor and 2x12's for sides and ends could shovel a load in a few minutes. The load, as I recall, was a little more than a yard. The rock ran from $\frac{1}{4}$ to 4 in. The sand was a good grade and about the correct proportion, at least we accepted it as such.

The mix was 1:2:4, and all batches were turned five times on the mixing platform. Wheelbarrows were the means of transportation. Sufficient water was used to make the mass workable and the water was not clear or clean. No attempt was made to obtain uniform grading in the coarse aggregate and more than 90% of the particles were round. As an admixture we used ordinary dirt. The mix was sufficiently wet that no spading was required. When the forms were removed there were no "honey-comb" spots. The curing required three days and consisted of three applications of water daily, with buckets. An inch of cement plaster completed the job. This reservoir has never been repaired and is in perfect condition today. Some few months later a five-story building was begun in Los Angeles and constructed under the same conditions. This building stands today as perfect as the day it was completed.

Going further into earlier concrete construction, I made an exhaustive study of certain cathedrals in the Republic of Mexico. The principal cities visited were Mexico City, Puebla, Colima, Oaxaca, Monterey and Guadalajara. It was impossible to ascertain the exact age of these structures. Data obtained from records in the various cities convinced me that none of them were less than five hundred years. These buildings were constructed under conditions similar to the methods employed by me in my first

The Worm Turns!

THE AUTHOR of the letter on this page is an engineer, or like a number of us in this industry perhaps more accurately an ex-engineer. The views he expresses are those held by not a few producers, judging from private conversations. However, he is the first to express them in print so pointedly and courageously. Most of us assume that the interests of the commercial aggregate industry are best promoted by the tightest of specifications. What are your views, Mr. Interested Reader?—The Editor.

concrete effort—with one exception—the cement apparently was made on or near the job.

Aggregates were obtained from a gravel bank. Some of the rock were 9 in. in diameter. Unreinforced steps, 3 in. thick, leading to the bell towers were actually worn through in places. I doubt very much if any foot ascending these stairs had ever known a shoe. Some of the towers contain as many as twelve bells weighing from 150 pounds to three tons each.

Some Present-Day Specifications

After viewing these stately structures and visiting my first concrete masterpieces, I am of the opinion that present-day specifications are too "technical." They do not conform to conditions surrounding the project because in the majority of cases they are copied verbatim from former specifications. No specification is universal. They are not the studious result of practical ideas. In most cases they are unfair to the producers of aggregates and the contractors.

Let me quote at this time from a portion of the specifications of a certain county in this state, "In case the plans or specifications do not require some work or material necessary and proper for the purpose of making the work complete in all its details, the contractor shall, nevertheless, be required to provide the same so that the work may be complete." Here is another, "No work which may be defective in its construction, or material which may be deficient in any of its requirements of these specifications will be considered as accepted in consequence of the failure of any inspector of construction, or superintendent connected with the work, to point out said defects or deficiencies during the construction."

Six years ago this county demanded a 4-in. maximum and 1-in. minimum for coarse aggregates; four years ago it was 3-in. maximum and $\frac{1}{2}$ -in. minimum; today it specifies close grading from 2-in. maximum to stone dust. What can we expect next? Can the producer plan for the future?

Facts Gleaned from Experience

Before going further in this discussion I want to qualify. I have performed the actual work of mixing and laying concrete in all parts of the world. I have been employed as engineer on some of the largest projects in this country. This practical experience has given me a decided advantage over my professional brethren and I feel that my opinion is on a par, at least, with those having a technical training only.

For the past eight years I have specialized in the production of concrete material and the construction of highways and structures and the following are some of the facts gleaned from my experience:

Rock dust does not produce harmful results in concrete if the aggregate is low in absorption. Many aggregates become coated if washed. The water-cement ratio is the proper method of mixing. Distilled water is, however, not necessary. A certain man well known throughout the world and particularly in the United States, ran a concrete test in Chicago. In one specimen he used clear, clean water and in the other water from the Chicago Drainage Canal. The specimen made with the canal water tested higher than the clear water specimen, in every respect. With all due respect to my fellow engineers, I challenge any one of them to run two consecutive tests on concrete and arrive at the identical result.

Grading of coarse aggregates is not essential only in so far as to preclude wide breaks from the maximum to the minimum. Round aggregates with fines, result in less voids and a more compact mixture. Concrete can be sufficiently cured in one-third the time ordinarily specified. A good subgrade is 90% of a paved highway. Too much steel reinforcing is used in structures today.

In conclusion I want to warn the expert (?) "stress" and "strainers" that by their absurd specifications they are slowly bankrupting the producer of aggregates and ruining the concrete highway paving industry.

EARL S. CASEY, C.E.,
Vice-President and General Manager,
Rock Products, Inc., Escondido, Calif.

Editorial Comment

Nothing ROCK PRODUCTS ever printed has attracted more interest or wider notice than the report in our issues of September 26 and October 10

What Are Unfair or Unethical Business Practices?

of the hearing held by the Wisconsin Department of Agriculture and Markets in its case against the Sand, Gravel and Stone Co-operative Association, and the mineral aggregate industry

of Milwaukee County generally, for alleged unfair and unethical practices. The original article was captioned "Can the State Compel Producers to Earn a Profit?" It has been referred to in many abstracts and digests of current business literature. *Printers' Ink*, for example, devoted a whole page to an abstract and comment.

In our issue of November 21, p. 49, under the caption "State of Wisconsin Dodges Issue in Sand and Gravel Competition Case," we published the decision of the State Department of Agriculture and Marketing to the effect that "no evidence was introduced . . . to establish unfair methods of competition . . . consequently the case must be dismissed." But, "the fact that the department cannot take action . . . should not be taken to mean that there is official approval of the conditions now existing. The present practices result from cut-throat competition and are economically wasteful, but do not constitute unfair competition."

Our first reaction, as we presume was that of many readers, was to jump to the conclusion that the state had dodged the issue, as political officers very frequently do, to avoid a more complicated situation, or what they think may prove a more complicated situation. Sober reflection on the issue and the decision has changed our first reaction, and we can see now that the decision is doubtless founded on good law, or legal precedent, and on good logic.

First let us consider, what are "unfair methods of competition" or "unethical practices"? That is, such methods or practices as constitute a violation of either common or statute law. As probably everyone knows, common law antedates all written laws or constitutions. It had its origin in the *common* or majority acceptance of certain principles of social conduct which came to be recognized by human beings with dawning intelligence and consciences as essential to the peace and well-being of their group or tribe. By acceptance isn't meant that these early ancestors of ours met in anything resembling "a trade practice conference" and mutually agreed that this, that and the other thing were highly desirable things to do, or not to do. By acceptance is meant that certain standards of social conduct were long established by actual practice of a majority of the tribe before they were ever thought of as law.

Consequently, of course, there could be no violation of common decency, or in other words of common law, until

it had actually become common law by common practice—the one who did not fall into line became the exception, the violator, the outlaw. All of our written laws are the outgrowth and development of this early common or unwritten law. They are attempts—sometimes abortive, as for example, the 18th amendment—to keep laws or rules of social conduct in line with our gradually increasing intelligence and our slowly unfolding consciences.

Assuming that is the mode of reasoning of a legal or judicial mind, it is easy to understand that there was "no evidence of unfair methods" in this case. It is true of course that these producers, as a group, had done what many another similar group has done; that is, they had met and drawn up and subscribed to a so-called code of ethics. Then they (meaning at least a goodly number of the group) had gone forth and proceeded to ignore the code and to do exactly as they had always done. The evidence submitted certainly proved *this* beyond all question of doubt. These producers, and their brother producers in every other line of endeavor, failed to appreciate that mere proclamation of a code of ethics did not establish the code either in an actual or legal sense. Only the common practice of such a code can give it any weight. Even the state cannot give it the force of law if common disregard of the code is established by the evidence.

In the last analysis all law is referred back to common law, or fundamental, elemental principles of right and wrong as the common man is able to distinguish them. The approval of a code of business ethics by the Federal Trade Commission, or even its incorporation in the statutes of the country would not insure or compel the practice of decent business methods. In other words it is pretty well recognized that laws regulating human conduct or human relations cannot be adopted much ahead of the general practice they are designed to enforce. And even if such laws were placed on the statute books, as many laws are, they could not be enforced so long as the conscience of the ordinary business man permitted him to do or to countenance these so-called unfair practices.

So, on sober second thought, we think the Wisconsin decision is a sound and logical one, and agree with the commissioner of the Department of Agriculture and Markets that: "The industry should consider steps to set its house in order and in doing so may expect the friendly cooperation of the department." The same applies to every other group we know of that has similar conditions and problems to meet. Practice of fair business competition *must* come before codes of business or trade ethics. If business men haven't faith enough in the justice or decency of fair business ethics to give them the force of common law by common practice, they need not expect them to have much force or influence as written law.

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

Stock	Date	Bid	Asked	Dividend	Stock	Date	Bid	Asked	Dividend
Allentown P. C. 1st 6's ²⁶	12- 2-31	80	90		Lawrence P. C.	11-30-31	18	22	\$1 qu. June 30
Alpha P. C. new com. ²	11-28-31	9	10	25c qu. Oct. 24	Lawrence P. C. 5½'s, 1942 ²⁸	11-28-31	47	55	
Alpha P. C. pfd. ²	11-28-31	90	105	1.75 qu. Dec. 15	Lehigh P. C. com.	12- 1-31	6½	7½	25c qu. May 1
Amalgamated Phosphate Co. 6's, 1936 ¹⁹	11-28-31	95	100		Lehigh P. C. pfd.	12- 1-31	80	85	1.75 qu. Jan. 2
American Aggregates com. ¹⁹	11-28-31	3½	5	75c qu. Mar. 1	Louisville Cement ¹	11-27-31	125	150	
American Aggregates pfd. ¹⁹	11-28-31	10	40	1.75 qu. Oct. 1	Lyman-Richey 1st 6's, 1932 ¹⁸	11-28-31	95		
Amer. Aggr. 6's, w.w. ¹⁹	11-28-31	45	55		Lyman-Richey 1st 6's, 1935 ¹⁸	11-28-31	90		
Amer. Aggr. 6's, ex-w. ¹⁹	11-28-31	42	52		Marblehead Lime 6's ¹⁴	11-27-31	No market		
Amer. L. & S. 1st 7's ²⁷	12- 2-31	88	92		Marbelite Corp. com. (cement products)	11-28-31		75c	
American Silica Corp. 6½'s ³⁰	12- 2-31	No market			Marbelite Corp. pfd.	11-28-31	1		50c qu. Oct. 10, '30
Arundel Corp. new com.	12- 1-31	26½	27	75c qu. Oct. 1	Material Service Corp.	12- 1-31	15	16½	50c qu. June 1
Bessemer L. & C. Class A ⁴	11-27-31		12½	50c qu. Aug. 1	McCrady-Rodgers 7% pfd. ²⁹	11-27-31	40		87½c qu. Sept. 30
Bessemer L. & C. 1st 6½'s ⁸	11-27-31		58		McCrady-Rodgers com. ²⁹	11-27-31	10	20	75c qu. Jan. 26
Bloomington Limestone 6's ²⁷	12- 2-31	20	25		Medusa Portland Cement	12- 2-31		20	75c qu. Apr. 1
Boston S. & G. new com. ³⁷	11-27-31	5	7	15c qu. Oct. 1	Michigan L. & C. com. ⁶	11-28-31	45		
Boston S. & G. new 7% pfd. ³⁷	11-27-31	32	37½	87½c qu. Oct. 1	Missouri P. C.	12- 1-31	16	18	25c qu. Oct. 31
California Art Tile, A.	11-27-31	1	5½	43¾c Mar. 31	Monolith Portland Midwest com. ⁹	11-27-31	75c	1	
California Art Tile, B ⁴	11-27-31		3	20c qu. Mar. 31	Monolith P. C. com. ⁹	11-27-31	1½	2	40c s.-a. Jan. 1
Calaveras Cement com. ⁹	11-27-31		10		Monolith P. C. pfd. ¹	11-27-31	3½	4	40c s.-a. Jan. 1
Calaveras Cement 7% pfd. ⁹	11-27-31		70	1.75 qu. Oct. 15	Monolith P. C. units ⁹	11-27-31	8½	10	
Canada Cement com.	12- 1-31	7	7½		Monolith P. C. 1st Mtg. 6's ⁸	11-27-31	65	70	
Canada Cement pfd.	12- 1-31	77½		1.62½ qu. Dec. 31	National Cem. (Can.) 1st 7's ²⁷	12- 2-31	95	100	
Canada Cement 5½'s ⁴²	11-26-31	91	95		National Gypsum A com. ²⁷	12- 2-31	1¾	2½	
Canada Crushed Stone bonds ⁴²	11-26-31	78	85		National Gypsum pfd. ²⁷	12- 2-31	37	39	1.75 qu. Jan. 2, '32
Canada Crushed Stone com. ⁴²	11-26-31	No market		National Gypsum 6's ³	11-25-31	74½	76½		
Canada Crushed Stone pfd. ⁴¹	10-27-31		75		Nazareth Cement com. ²⁵	9-19-31		10	
Certaineet Products com. ¹²	1- 1-31	3	3½		Nazareth Cement pfd. ²⁵	9-19-31		85	
Certaineet Products pfd.	12- 1-31	22	33	1.75 qu. Jan. 1	Newaygo P. C. 1st 6½'s ²⁷	12- 2-31	70	75	
Cleveland Quarries	12- 2-31		50	25c qu. Dec. 1	New England Lime 6's, 1935 ¹⁹	11-28-31		80	
Columbia S. & G. pfd.	12- 1-31	89	91		N. Y. Trap Rock 1st 6's ¹	12- 1-31	83	84½	
Consol. Cement 1st 6½'s, A ⁴⁴	12- 2-31	5	10		N. Y. Trap Rock 7% pfd. ³⁰	11-30-31	65		1.75 qu. July 1
Consol. Cement notes, 1941 ²⁷	12- 2-31	No market		North Amer. Cem. 1st 6½'s ¹	11-30-31	25½	27		
Consol. Cement pfd. ²⁷	12- 2-31		58		North Amer. Cem. com. ²⁷	12- 2-31	50c	1½	
Consolidated Oka Sand and Gravel (Canada) 6½'s ¹²	11-30-31	95	97		North Amer. Cem. 7% pfd. ²⁷	12- 2-31	4½	6	
Consolidated Oka Sand and Gravel (Canada) com. ⁴¹	10-27-31		7		North Shore Mat. 1st 5's ¹⁸	12- 2-31	No market		
Consolidated Oka Sand and Gravel (Canada) pfd. ⁴¹	11-17-31	61			Northwestern States P. C. ³¹	11-28-31	68		\$2 Apr. 1
Consol. Rock Prod. com. ⁹	11-27-31	25c	35c	1.75 qu. Oct. 10	Ohio River S. & G. com.	12- 1-31		8	
Consol. Rock Prod. pfd. ⁹	11-27-31	2	2½	43¾c qu. June 1, '30	Ohio River S. & G. 7% pfd.	12- 1-31		98	
Consol. Rock Prod. units	11-28-31	3	5		Ohio River S. & G. 6's ¹⁴	11-30-31	60	70	
Consol. S. & G. pfd. (Can.)	12- 1-31	50	55	1.75 qu. Nov. 16	Oregon P. C. com. ⁹	11-27-31	8	12	
Construction Mat. com.	12- 1-31	1½	3		Oregon P. C. pfd. ⁹	11-27-31	80	85	
Construction Mat. pfd.	12- 1-31	4	11½	87½c qu. Aug. 1	Pacific Coast Aggr. com. ⁴⁰	11-27-31		25c	
Consumers Rock and Gravel, 1st Mtg. 6's, 1948 ³⁵	11-27-31	55	61		Pacific Coast Aggr. pfd. ⁴⁰	11-27-31		1	
Coosa P. C. 1st 6's ²³	11-27-31	25		Pacific Coast Cement 6's ⁶	11-27-31	77			
Coplay Cem. Mfg. 1st 6's ¹⁹	11-28-31	40	60		Pacific P. C. com.	11-27-31		8 actual sale	
Coplay Cem. Mfg. com. ³³	11-28-31	5	7½		Pacific P. C. 6's ⁵	11-27-31	90		1.62½ qu. Oct. 5
Coplay Cem. Mfg. pfd. ³³	11-28-31	25	40		Peerless Cement com. ²¹	11-28-31	25c	1	
Dolese and Shepard	12- 1-31	24	26	\$1 qu. Oct. 1	Peerless Cement pfd. ²¹	11-28-31	5	15	1.75 qu. Apr. 1
Dufferin Pav. & Cr. Stone pfd.	12- 1-31		68	1.75 qu. Oct. 1	Penn.-Dixie Cement com.	12- 1-31	1¼	1½	
Dufferin Pav. & Cr. Stone com.	12- 1-31		5½	6	Penn.-Dixie Cement pfd.	12- 1-31	6½	8	
Edison P. C. com. ³²	11-27-31	1½		Penn.-Dixie Cement 6's	12- 1-31	40 actual sale			
Edison P. C. pfd. ³²	11-27-31	5		Penn. Glass Sand Corp. 6's	11- 6-31	92	96		
Federal P. C. 6½'s, 1941 ¹⁰	11-28-31		80		Petroskey P. C.	12- 1-31	3¼	4¼	15c qu. Apr. 1
Giant P. C. com. ²	11-28-31	2	5		Port Stockton Cem. com. ⁹	11-27-31	No market		
Giant P. C. pfd. ²	11-28-31	10	15	1.75 s.-a. Dec. 15	Riverside Cement com. ⁹	11-27-31	4	6	
Gyp. Lime & Alabastine, Ltd.	12- 1-31	5	5½	10c qu. Oct. 5	Riverside Cement pfd. ⁹	11-27-31	55	60	1.50 qu. Nov. 1
Gyp. Lime & Alabastine 5½'s ⁴²	11-26-31	64	69		Riverside Cement, A ⁹	11-16-31	6½	10	15c qu. Feb. 1
Hermitage Cement com. ¹¹	11-28-31	15	20		Riverside Cement, B ⁹	11-27-31	70c	1	
Hermitage Cement pfd. ¹¹	11-28-31	60	70		Roquemore Gravel 6½'s ¹¹	11-28-31	98	100	
Ideal Cement, new com. ²⁹	11-27-31	20	23	50c qu. & 50c ex. Oct. 1	Sandusky Cement 6½'s, 1931-37 ¹⁹	11-28-31	90	100	
Ideal Cement 5's, 1943 ²⁹	11-27-31	99	100		Santa Cruz P. C. com.	11-27-31	80	85	\$1 qu. Oct. 1
Illinois Electric Limestone 1st 7's ³⁵	9-18-31		90		Schumacher Wallboard com.	11-27-31		6	25c qu. June 27
Indiana Limestone units ²⁷	12- 2-31	No market		Schumacher Wallboard pfd.	11-27-31	12	14	50c qu. Nov. 15	
Indiana Limestone 6's	11-28-31	12½		Southwestern P. C. units ³⁵	11-27-31	225	275		
International Cem. com.	12- 1-31	21	22	75c qu. Dec. 31	Standard Paving & Mat. (Canada) com.	12- 1-31	4	4½	50c qu. May 16
International Cem. bonds, 5's ⁸	12- 1-31	73½	74½	Semi-ann. int.	Standard Paving & Mat. pfd.	12- 1-31	60	17½ qu. Nov. 16	
Iron City Sand & Gravel 6's, 1940 ³⁶	11-27-31		80		Superior P. C. A	11-27-31	29½	32½	25c qu. mo. Dec. 1
Kelley Is. L. & T. new stock	12- 2-31	15½	19½	50c qu. Oct. 1	Superior P. C. B	11-27-31	8	12	25c qu. Mar. 20
Ky. Cons. Stone com.	12- 1-31	3½	4½		Trinity P. C. com. ³¹	11-28-31	80	90	
Ky. Cons. Stone pfd.	12- 1-31		77½	1.75 qu. May 1	U. S. Gypsum com.	12- 1-31	26	26½	40c qu. Dec. 31
Ky. Cons. St. 1st Mtg. 6½'s ³⁸	11- 4-31		70		U. S. Gypsum pfd.	12- 1-31	116	118	1.75 qu. Dec. 31
Ky. Cons. Stone V. T. C. ³⁸	11- 4-31		2		Wabash P. C. ²¹	11-28-31		21	
Ky. Rock Asphalt com.	12- 1-31	3½	4½	40c qu. Oct. 1, '30	Warner Co. com. ¹⁰	11-30-31	6½	7	25c qu. Oct. 15
Ky. Rock Asphalt pfd.	12- 1-31	36	40	1.75 qu. Dec. 1	Warner Co. 1st 7% pfd. ¹⁰	11-30-31		85	1.75 qu. Jan. 1, '32
Ky. Rock Asphalt 6½'s	12- 1-31	85	88		Warner Co. 1st 6's 1944 w.w.	12- 2-31	66 actual sale		

Quotations by: ¹Watling Lerchen & Hayes Co., Detroit, Mich. ²Bristol & Willett, New York. ³Rogers, Tracy Co., Chicago. ⁴Butler, Beadling & Co., Youngstown, Ohio. ⁵Smith, Camp & Riley, San Francisco, Calif. ⁶Frederick H. Hatch & Co., New York. ⁷J. J. B. Hilliard & Son, Louisville, Ky. ⁸Dillon, Read & Co., Chicago, Ill. ⁹A. E. White Co., San Francisco, Calif. ¹⁰Lee Higgins & Co., Boston and Chicago. ¹¹J. W. Jakes & Co., Nashville, Tenn. ¹²James Richardson & Sons, Ltd., Winnipeg, Man. ¹³Stern Bros. & Co., Kansas City, Mo. ¹⁴First Wisconsin Co., Milwaukee, Wis. ¹⁵Central-Republic Bank & Trust Co., Chicago. ¹⁶J. S. Wilson, Jr., Baltimore, Md. ¹⁷Citizens Southern Co., Savannah, Ga. ¹⁸Dean, Witter & Co., Los Angeles, Calif. ¹⁹Hewitt, Ladin & Co., New York. ²⁰Tucker, Hunter, Dulin & Co., San Francisco, Calif. ²¹Baker, Simonds & Co., Inc., Detroit, Mich. ²²Peoples-Pittsburgh Trust Co., Pittsburgh, Penn. ²³Howard R. Taylor & Co., Baltimore. ²⁴Richards & Co., Philadelphia, Penn. ²⁵Hincks Bros. & Co., Bridgeport, Conn. ²⁶Bank of Republic, Chicago, Ill. ²⁷National City Co., Chicago, Ill. ²⁸Chicago Trust Co., Chicago, Ill. ²⁹Boettcher-Newton & Co., Denver. ³⁰Hanson and Hanson, New York. ³¹S. F. Holzinger & Co., Milwaukee, Wis. ³²Tobey and Kirk, New York. ³³Steiner, Rouse and Co., New York. ³⁴Jones, Heward & Co., Montreal, Que. ³⁵Tenney, Williams & Co., Los Angeles, Calif. ³⁶Stein Bros. & Boyce, Baltimore, Md. ³⁷Wise, Hobbs & Arnold, Boston. ³⁸E. W. Hays & Co., Louisville, Ky. ³⁹Blythe Witter & Co., Chicago, Ill. ⁴⁰Martin Judge Co., San Francisco, Calif. ⁴¹A. J. Pattison Jr. & Co., Ltd., Toronto, Canada. ⁴²Nesbitt, Thomson & Co., Toronto. ⁴³E. H. Rollins, Chicago. ⁴⁴Dunlap, Wakefield & Co., Louisville, Ky. ⁴⁵Dan Powell & Co., Los Angeles.

Proposed Refinancing of Peerless Portland Cement

THE FOLLOWING AGREEMENT dated October 31, 1931, for the Peerless Portland Cement Corp.'s (Detroit, Mich.) bonded indebtedness represented by first mortgage convertible serial gold bonds has been proposed: (1) The maturity of all bonds due on January 2, 1932, and thereafter to and including January 2, 1939, shall be extended to January 2, 1940. (2) Holders of bonds maturing January 2, 1940, shall also concur in the plan. (3) In lieu of payment of the principal and interest sinking funds provided for in the trust deed securing said bonds, there shall be an annual sinking fund of an amount equal to 30% of the net earnings of the Peerless Cement Corp., said earnings to be before depreciation, but after interest and federal taxes, as determined by good accounting practice, and shall be based upon the company's earnings for each calendar year beginning with the year 1932. Said moneys paid into the sinking fund shall be used to retire the outstanding bonds of said issue at par and accrued interest, said bonds to be drawn by lot by the trustee from the serials first maturing, as provided in the original trust deed. Interest as above reserved shall be paid by the company semi-annually in lieu of monthly deposits.

The readjustment plan shall become operative as soon as the bankers, Peabody and Co., Chicago, in their discretion shall determine that a sufficient number of bonds have been deposited with Detroit Trust Co., Detroit, Mich., depositary, to make it advisable to declare the plan operative.

NINE MONTHS' EARNING STATEMENT

	9 mos. to September	Year to December
Income account:	30,1931	31,1930
Net from sales.....	\$824,377	\$2,179,116
Operating and selling expenses, etc.	1,005,549	1,530,949
Depreciation	288,825	432,699
Balance for interest and federal taxes.....(d)	\$469,997	\$215,468
Balance sheet, as of: September	December	
Assets: 30,1931	31,1930	
*Plant and equipment.....\$6,252,418	\$6,546,841	
Investments	193,423	180,122
Current assets:		
Cash	136,458	58,506
Notes and accounts receivable (net).....	197,011	274,237
Inventories	1,002,579	1,561,994
Special accounts	24,955	.....
Prepaid items	44,846	69,374
Sinking fund	10,000	.....
Bond discount and expense.....	113,797	134,564
Deferred charges	38,344	4,546
Total.....	\$8,013,831	\$8,830,184
Liabilities:		
Preferred stock	\$ 414,000	\$ 440,500
*Common stock	5,582,208	5,962,832
Surplus	179,767	.....
Funded debt	1,522,500	1,701,500
Other long term debt.....	71,940	157,032
Current liabilities:		
Notes payable	213,437	260,000
Accruals	16,386	41,935
Accounts payable	26,860	86,617
Bonds due	166,500	.....
Total.....	\$8,013,831	\$8,830,184
Current assets	\$1,361,003	\$1,894,737
Current liabilities	423,183	388,552
Working capital.....	\$ 937,820	\$1,506,185

*After depreciation: 1931, \$3,063,747; 1930, \$2,752,993. [†]Represented by no par shares: 1931, 238,854; 1930, 238,389.

Omit Warner Co. Dividend

WARNER CO., Philadelphia, Penn., has omitted the dividend on the common stock due at this time. Three months ago the company paid 25 c. on the common.

Regular quarterly dividends of \$1.75 each on the first and second preferred stocks were declared, both payable January 1 to stock of record December 15.

The announcement made by Charles Warner, president of the company, stated:

"The volume of business this year has been less than in 1930 and prices have continued unduly low. Nevertheless, the company has been able to show satisfactory operating results under such conditions, and, after providing for extensive depreciation and depletion charges, should show for the current year earnings more than sufficient to pay its bond interest and first preferred dividend and also to pay the greater part of its second preferred dividend. To meet the prevailing conditions many economies which should result in substantial future savings have been effected.

"The company continues to enjoy a strong cash position, the quick ratio October 31 exceeding 7 to 1. The omission of the common stock dividend at this time fortifies this position and was deemed wise in the best interest of stockholders.

"The depression causes temporary doubling up and the exercise of many economies in living and business. The subnormal rate of private construction which started to decline rapidly two years ago is still continuing. This condition unquestionably is moving steadily towards the absorption of construction surpluses in buildings and homes.

"With the return to better business conditions the application of normal demand will again show that a deficiency in modern structures exists in many districts, since private construction has been running for nearly two years at a rate substantially below the average increase in demand for these facilities.

"The company during this depression has continued to hold its proportion of the business available, and is in good position to benefit by the expansion in business as our country returns to normal."

Arundel Corp. Earnings

THE Arundel Corp., Baltimore, Md., sand and gravel producer and dredging contractor, reports for the 10 months ended October 31, 1931, net profit of \$2,001,946, after depreciation, federal taxes, etc., equivalent to \$4.04 a share on 495,556 no par shares of capital stock. This compares with \$2,290,994, or \$4.62 a share, in the first 10 months of 1930.

October net profit was \$267,558 after taxes and charges, against \$333,893 in October, 1930.

Current assets on October 31, last, were \$4,310,409, and current liabilities \$474,492.

Opposes Northwestern States Portland Cement Company Changes

JUDGE RANKIN of Keokuk, Ia., took under advisement two defense motions in a suit brought by F. A. Ontjes, attorney, to enjoin the Northwestern States Portland Cement Co. from changing from a West Virginia to an Iowa corporation.

Earl Smith, attorney for the stockholders' committee, composed of W. G. C. Bagley, Frank J. Hanlon and Hanford MacNider, argued one motion to require Mr. Ontjes, a stockholder, to present a more specific statement, and another to strike out certain portions of the injunction petition.

Mr. Ontjes has added to his petition as an amendment copy of his claim that the late C. H. MacNider, president of the cement company and of the First National Bank, should have turned over to the cement company 33,000 shares of Alpha Portland Cement Co. stock.

The claim for \$2,393,143 and interest has been filed against the C. H. MacNider estate.

The stockholders committee maintains that the late C. H. MacNider's purchase of Alpha Portland Cement Co. stock was Mr. MacNider's personal purchase, entirely separate from the purchase of other shares of Alpha stock by the Northwestern States company.

Stockholders of the Northwestern States Portland Cement Co. are offered two \$50 shares in the proposed Iowa company for each \$100 share in the West Virginia company, the amount of capital remaining the same.—*Des Moines (Ia.) Register*.

Recent Dividends Announced

Alpha Portland Cement pfd.

(qu.)	\$1.75,	Dec. 15
Canada Cement pfd. (qu.)	1.62½,	Dec. 31
International Cement (qu.)	0.75,	Dec. 31
Johns-Manville com. (qu.)	0.25,	Jan. 16
Johns-Manville pfd. (qu.)	1.75,	Jan. 2
National Gypsum pfd. (qu.)	1.75,	Jan. 2
Warner Co. 1st pfd. (qu.)	1.75,	Jan. 1
Warner Co. 2nd pfd. (qu.)	1.75,	Jan. 1

Pacific Portland Cement

PACIFIC Portland Cement stock was one of the few issues to move against the reactionary trend on the San Francisco Curb recently. This stock jumped 3 points—according to some observers, in reflection of the belief that the company is experiencing a revival in business. It is understood that inquiries on good sized building projects are being received and that many projects planned some months ago and then pigeonholed now are being reconsidered. Pacific Portland, as an extremely low cost producer, is in a position to benefit from any improvement in the building industry where competitive bidding is one of the requirements of winning contracts.—*Pacific Coast Edition of the Wall Street Journal*.

Nine Months' Earnings of Southern Asbestos Co.

THE EARNINGS statement of the Southern Asbestos Co., Charlotte, N. C., for the nine months January 1, to September 30, 1931, are reported as follows:

Gross profit	\$82,935
Selling, administrative and general expense	63,820
Depreciation	19,651
Operating loss	536
Other income	5,204

Net income

\$4,668

BALANCE SHEET	
	September
Assets:	
30, 1931	December
*Plant and equipment.....	31, 1930
Processes, good-will, etc...	\$466,689
Current assets:	518,000
Inventories	213,158
Cash	10,325
Accounts receivable (net)	33,371
Due from affiliated companies	131,513
Investments in real estate..	19,950
Claim receivable	14,225
Prepaid expenses	3,230
Total	\$1,386,632
Liabilities:	
†Capital stock	\$1,503,200
Surplus	(d) 125,798
Current liabilities:	
Accounts payable, etc....	9,230
Deferred amount payable (due 1932)	81,485
Total	\$1,386,632
Current assets	\$388,367
Current liabilities	9,230
Working capital	\$379,137
*Less depreciation: 1931, \$129,866; 1930, \$110,162. †Represented by 89,960 no par shares.	\$365,413

Highland Sand and Gravel Co. Statement

THE Highland Sand and Gravel Co., West Roxbury, Mass., has reported its annual statement December 31, 1930, as follows:

ASSETS	
Deposit—sand and gravel.....	\$ 50,000
Machinery	110,501
Tools and equipment	100
Cash	3,200
Accounts receivable	76,248
Securities	20,000
Notes receivable	440
Deferred charges	2,330
Furniture, fixtures, supplies.....	426
Vehicles	8,589
Subscribers to capital stock	450
Total	\$272,284

LIABILITIES	
Accounts payable	\$ 22,243
Notes payable	49,668
10,307 shares no par value.....	200,373
Total	\$272,284

Untangling Finances of National Cement Co. (Canada)

HOLDERS of 7% series first mortgage bonds of the National Cement Co. of Canada (1923 company) will meet in Montreal, Que., on December 15 to consider the contemplated distribution of assets of the 1923 company among shareholders and the liquidation of the concern. They will consider the effect of this action upon their position of bondholders and their security and, at the same time, will pass resolutions more clearly defining the rights and obligations of the National Cement Co. (1923 company) in respect to the trust deed.

The National Cement Co. came into being in 1923 for the purpose of establishing in Montreal a portland cement plant with a capacity of 1,000,000 bbl. annually. It commenced production in November, 1925, and in the same year a new company was formed with the same name, being generally known as the 1925 incorporation. In 1928 control of the company was acquired by Alfred Rogers of Toronto, Ont., and in August, 1929, it was sold to the Canada Cement Co.

mus for nine months with no warehouse set.

The attitude of all consumers is that American cement is more uniform than European, and preferable when obtainable on an equal price basis, but in spite of advantages in shipping facilities and proximity the price differences are too great. In one recent instance German cement sold in Cristobal at \$1.95, c.i.f., a barrel, and European cement has come to the Isthmus at \$1.89 a barrel. However, such rates are ordinarily obtained only from vessels carrying full cement cargo to the west coast of South America.

Local engineers are said to be of the opinion that Panama offers only a sporadic or temporary market, with occasionally a large demand for a short period.

Purchases of cement for the Canal Zone are regularly arranged in Washington, D. C., through the Panama Canal Commission when intended for use by the Canal, or through the War or Navy Departments when intended for the local activities of either. In the case of large projects the contractors or successful bidders purchase the cement.

The above information on charges and prices, local markets and possible production on this island, are contained in special circular 12 of the Minerals Divisions of the U. S. Bureau of Foreign and Domestic Commerce.

Missouri Road Work in 1932 Depends on Bond Market

A PROGRAM of construction work for 1932 has been mapped out in division 9 of the Missouri highway department.

Mr. Francisco pointed out at the same time, however, that the amount of this program which actually can be carried out will depend entirely upon the state's ability to market additional road bonds and to obtain necessary rights of way.

The state recently sold some of its bonds at a discount and announced that no more of the bonds would be sold under such conditions. This situation threatens to curtail the construction program. — *Springfield (Mo.) Leader*.

Canadian Gypsum Plans New Plant

CANADIAN GYPSUM PRODUCTS, a holding organization for the Canadian interests of the United States Gypsum Co., plans to undertake shortly the construction of a plant at Wentworth, N. S., for the manufacture of gypsum products.

Over the past 12 months Canadian Gypsum Products has followed a policy of making its products in Canada as far as possible.

It is stated that in the past 90% of the gypsum mined in Canada has been exported to the United States for manufacture, but now an increasing amount of the total produced will be turned into the various products in Canadian plants.—*Toronto (Ont.) Financial Post*.

Source	1927 Bbl.	1928 Bbl.	1929 Bbl.	1930 Bbl.
Belgium	800	2,665	11,198	7,739
France		200	405	364
Germany	53,789	64,673	64,215	31,281
Netherlands	5	5,596	344	.....
Norway	19,471	44,434	70,602	103,291
Sweden	2,039	9,760	2,266	3,589
Italy	3,018	50	.....	.....
United Kingdom	370	.....	.....	.....
United States	3,604	17,520	14,385	4,254
Other countries .....	.....	.....	17	.....

Total..... 82,726 145,268 163,415 150,535

Panama's shipping connections with the United States are better than those of any other Latin American country, and this proximity gives the United States manufacturers the advantage of better deliveries than are possible to Europeans, an important factor, as cement does not keep well in the Panama climate. In addition European cement shipments have a higher percentage of breakage.

Merchandise packed in accordance with ordinary export requirements and water-proofed will almost invariably be received in good condition. Local interests state that 30 days is the limit for storage on the Pacific side and 18 on the Atlantic. Another informant, believed to be reliable, states that cement shipped in a valve bag and pitch-sealed can be stored anywhere on the Isth-

Traffic and Transportation

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week of November 28:

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

23783. **Stone, crushed**, in bulk in gondola or other open-top cars (See Note 3), from Westfield, Mass. (Hampden Quarry), to Millville Heights, Mass. Present rate, \$1.35 per net ton; proposed, \$1.10. (See Note 4.)

TRUNK LINE ASSOCIATION DOCKET

Sup. to 27944. Amend Rate Proposal No. 27944 covering **sand and gravel**, carloads, from Kenvil and Springfield, N. J., to Bethlehem and Allentown, Penn., by changing the commodity description to read as follows: "Sand (other than blast, engine, fire, foundry, glass, molding, quartz, silex and silica sand) and gravel, carloads."

28046. **Stone, crushed or broken**, carloads (See Note 2), from Oriskany Falls, N. Y., to Sidney, N. Y., 75c per net ton. Present rate, 91c. Reason—Proposed rate is fairly comparable with rate from Schoharie, N. Y., to Sidney, N. Y.

28047. **Gravel and sand**, N. O. I. B. N. in O. C., except blast, engine, foundry, glass, molding, quartz, silex and silica, carloads (See Note 2), from Sherburne Four Corners, N. Y., to Hancock, N. Y., 80c per net ton. Present rate, \$1. (See Note 4.)

28065. **Limestone, crude, fluxing, foundry and furnace**, when shipped in open-top equipment (See Note 2), from Ashton, Big Spring, Cavetown, Charlton, Hancock, Kemps, Pinesburg, Williamsport, Md.; Nessle, W. Va.; Dittinger, Hanover, Thomasville and York, Penn.; Cleveland, Lorain, Zanesville, O., \$2.39; Mingo Junction, Steubenville, Yorkville, O., Wheeling, W. Va., \$1.51, and Toledo, O., \$3 per gross ton. Reason—Proposed rates are comparable with rates from the Martinsburg district and Bellefonte, Penn.

28079. **Ground limestone**, carloads, minimum weight 50,000 lb., from York, Penn., to Union Stone Co., Bainbridge, Billmyer, Penn., 14c per 100 lb. (See Note 5.)

28080. To establish rates on **crude limestone and crude fluxing limestone**, carloads, from Billmyer, Penn., to all destinations shown in tariffs listed below at the same rates and carload minimum weights as are now applicable from stations Bainbridge, Penn.:

G. O., I. C. C. 14302	I. C. C. 477
G. O., I. C. C. 14485	I. C. C. 509
G. O., I. C. C. 14287	I. C. C. 466
G. O., I. C. C. 14306	I. C. C. 566
G. O., I. C. C. 14761	
G. O., I. C. C. 14357	
G. O., I. C. C. 13804	

28082. **Ground limestone**, carloads, minimum weight 50,000 lb., from Jamesville, N. Y., to stations on the D. & H. Corp., rates per net ton:

Prop. Pres.

Harpusville to Afton, N. Y., inclusive	\$1.71	\$1.65
Bainbridge to Colliers, N. Y., inclusive	1.83	1.65
Maryland, N. Y.	1.96	1.65
Hyndsville to Sharon Springs, N. Y., inclusive	2.20	2.10
Cherry Valley, N. Y., inclusive	2.21	2.10
Howes Cave to Delanson, N. Y., inclusive	2.20	2.10
South Schenectady, N. Y.	2.21	1.65
Schenectady to Troy, N. Y., inclusive	2.21	1.65
Lansingburg, N. Y.	2.34	1.65
Cohoes, N. Y.	2.21	1.65

28087. **Stone, natural (other than bituminous asphalt rock), crushed**, N. O. I. B. N. in O. C., carloads (see Note 2), from White Haven, Penn., to Mayfield, Penn., \$1.20 per net ton. Present rate, \$1.25 per net ton. (See Note 5.)

28090. **Sand, other than blast, engine, foundry, glass, molding or silica**, carloads (See Note 2). From Shippensburg, Fayetteville and Pond Bank, Penn.

To Prop. Pres.
St. James, Md. 100 125
Antietam, Md. 110 125

From Mont Alto, Penn. Prop. Pres.

Prop. Pres.
Antietam, Md. 110 125
St. James, Md. 110 125

Proposed and present rates in cents per 2000 lb. Reason—Proposed rates are comparable with rates from Georgetown, D. C., to Breatheds, Keevysville and Eakels Mill, Md.

28094. **Sand and gravel**, other than blast, engine, foundry, glass, molding or silica, carloads (See Note 2), from Susquehanna, Penn., to Forest City, Penn., 65c per net ton. Present rate, 70c. (See Note 4.)

28095. **Crushed stone**, carloads (See Note 2), from Pompton Lakes, N. J., to Lackawaxen, Penn., \$1.20; Great Bend, Herrick Centre, Thompson, Penn., \$1.60; Dunmore, Penn., \$1.40, and Saco, Penn., \$1.30 per net ton. (See Note 5.)

27931, Sup. 1. **Ground limestone**, carloads, minimum weight 50,000 lb., from the Western Maryland Ry., Cavetown-Pinesburg and Thomasville-Bittinger districts, to Maybrook, N. Y., to Buttsville, N. J., inclusive, 19c per 100 lb.

28108. **Crushed stone**, carloads (See Note 2), from Trap Rock, Penn., to Landenberg, Penn., \$1.05 per net ton. Present rate, \$1.25. Reason—Proposed rate is comparable with rate from Monocacy to Landenberg, Penn.

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

Note 4—Reason—To meet motor truck competition.

Note 5—Reason—Proposed rates are comparable with rates on like commodities for like distances, services and conditions.

CENTRAL FREIGHT ASSOCIATION DOCKET

29796. To establish on **crushed stone** (in bulk), from Alsace, Penn. (L. E. F. & C. R. R.), to N. Y. C. stations, viz.: Ashtabula, Dorset, Andover, O., Jamestown, Branch, Oil City, Niles, Lamberton Spur, Elmo, Glenn, Rose Siding, Penn., Stanhope, Doughton, Youngstown, Latimer, Hubbard, O., Sharon, Sharpsville and West Middlesex, rates of 130, 120, 120, 110, 100, 100, 90, 80, 80, 90, 120, 130, 140, 130, 130, 140, 140, 140c per net ton. Present rates, sixth class.

29799. To establish on **core sand**, carloads, from Juniata, Wampson, McHale and Sargent, Mich., to Sidney, O., rate of 239c per net ton. Present rate, 252c (rate in effect from the Juniata group to Dayton and Cincinnati, O.).

29801. To establish on **granulated slag**, carloads, minimum weight 80% of marked capacity of car, from Lowellville, O., to Tippecanoe City, O., rate of 21½c. Route—Via P. R. R., Dalton, O., and B. & O. R. R. Present rate, \$1.50 per net ton.

Sup. to W. D. A. 29801. Correction Notice. White Docket Advice No. 29801, Docket Advice No. 29801, Docket Bulletin No. 2075, dated November 13, 1931, covering proposal to establish rate on **granulated slag**, carloads, from Lowellville to Tippecanoe City, O., should be corrected as follows: Proposed rate, 150c per net ton. Present rate, 21½c.

29811. To establish on **crushed stone**, carloads, from Greencastle, Ind., to Campbellsburg, Ind., rate of 100c per net ton. Present rate, 115c.

29872. To establish on **sand and gravel**, from Terre Haute, Ind., to Petersburg, Ind., rate of 80c per net ton, via C. C. C. & St. L. Ry. (E. I. & T. H. Ry. Division), to expire November 1, 1932. Present rate, 95c.

29881. To establish on **sand and gravel**, carloads, to Paoli, Ind., from Rockport, Tell City, Cannelton, Ind., 100c, and from Evansville, Ind., 105c per net ton. Present, class rates.

29897. To establish on **crushed stone**, carloads, from Piqua, O., to Ottawa, O., rate of 90c per net ton, D. T. & I. R. R. delivery. Present rate, 13½c.

29901. To establish on **crushed stone**, carloads, from Putnamville, Ind., to Lewis, Black Hawk, 98c; Blanford, Bradshaw and West Clinton, Ind., 113c per net ton. Present, classification basis.

SOUTHERN FREIGHT ASSOCIATION DOCKET

55880. **Bituminous rock, crushed or ground**, carload minimum weight 80,000 lb., except when for carriers' convenience car of less capacity is furnished, in which event marked capacity of car, but

not less than actual weight, will govern (in such instances bills of lading and waybills should carry certificate over agent's signature, car of greater capacity not available), but in no case less than 50,000 lb., the minimum weight to be charged for on each car when actual amount is less, from I. C. R. R. producing points, viz.: Big Clifty, Roseport, Summit, Black Rock, Kosmosdale, Ky., to Norfolk and Newport News, Va. (for coastwise movement to United States and Canadian points north of Hampton Roads, Va., also for export to foreign countries. It is proposed to establish through rate of 385c per net ton (not to include wharfage or tipple charges) from and to the points named above, which rate is based same as recently approved from Bowling Green, Ky.

55905. **Bituminous rock asphalt** from Kentucky bituminous asphalt producing points to destinations north of the Ohio river within a radius of 150 mi. from the nearest producing point. Present rates, as shown in Agent Speiden's I. C. C. 1388 on an origin group plan basis. It is proposed to establish rates on bituminous rock asphalt as described in Agent Speiden's I. C. C. 1388 from all Kentucky producing points to points in C. F. A. territory within a radius of 150 mi. from the nearest producing point, rates to be figured on a point to point mileage basis.

55933. **Crushed stone**, carloads, from Boxley, Va., Greystone and Lassiter, N. C., to Norfolk, Kilby, Suffolk and Portsmouth, Va. It is proposed to restrict rate of 90c per ton of 2000 lb. on granite or stone, crushed or rubble, carloads, from Greystone, N. C., to Norfolk, Kilby, Suffolk and Portsmouth, Va., so as not to be subject to Agent Jones' I. C. C. U. S. 1 in constructing combination rates. It is proposed to restrict rate of 100c per ton of 2000 lb. on stone, crushed or rubble, carloads, from Boxley, Va., and Lassiter, N. C., to Norfolk, Va., as published in Supplement No. 10 to A. C. L. R. R. Virginia Points Tariff 5, I. C. C. B-2636, and in Supplement No. 105 to Agent Glenn's Freight Tariff 88-A, I. C. C. A-655, to the following delivery at Norfolk: "Applies via Pinners Point, Va., and Norfolk and Portsmouth Belt Line R. R. or via Pinners Point, Va., and lighterage, subject to following additional charges: Switching, as per Norfolk and Portsmouth Belt Line R. R. Tariff I. C. C. 91, supplements thereto or reissues thereof. Lighterage, 270c per car. Consignee to furnish berth for lighter."

56041. **Crushed marble or marble chips**, carloads, Mobile, Ala., Pensacola, Fla. (import, applicable from shipside), to Albany, Ga. At present class rates apply. It is proposed to establish rates on crushed marble or marble chips, carloads, to Albany, Ga., from Mobile, Ala., 200c per net ton, and from Pensacola, Fla., 170c per net ton (import, applicable from shipside).

56048. **Phosphate rock, crude lump or phosphate rock, crude ground, or limestone, phosphatic**, carloads, Tennessee points to transcontinental points. Present rate, \$18.45 per net ton (combination). Proposed rate on phosphate rock, crude lump or phosphate rock, crude ground, or limestone, phosphatic, in bulk or in bags, carloads (See Note 3), from Academy, Aetna, Arnold, Ashwood, Bic, Buffalo, Campbells, Carters Creek, Centreville, Columbia, Darks Mill, Darts, Easton, Franklin, Glover, Godwin, Gordonsburg, Harding, Hermitage, Irad, Jakfoso, Kleburne, Mt. Pleasant, Otey, Peytona, Pulaski, Ridley, Seth, Shipp, Siglo, Spring Hill, Swan Creek Jct., Thompsons, Two-mey, Wales and Ward Jct., Tenn., to destinations in Agent Toll's Transcontinental Tariffs 1-J, I. C. C. 1257, and 4-G, I. C. C. 1265, taking Rate Basis 1, 2 and 3 rates, and arbitraries over, \$12.93 per net ton.

56071. **Phosphate rock, ground or pulverized**, viz., acidulated (acid phosphate), or super-phosphate (acid phosphate), carloads, Wales, Tenn., to Chatham, London, Iugersoll, Norwich, Hamilton, Welland, Toronto, and West Toronto, Ont. At present combination rates apply. It is proposed to establish rates on phosphate rock, ground or pulverized, viz., acidulated (acid phosphate), or super-phosphate (acid phosphate), carloads, from Wales, Tenn., to Chatham, London, Iugersoll, Norwich, Ont., 684c; Hamilton and Welland, Ont., 689c, and to Toronto and West Toronto, Ont., 759c per net ton.

56111. **Phosphate rock, crude lump, or phosphate rock, crude ground, or limestone, phosphatic**, carloads, N. C. & St. L. Ry. and L. & N. R. R. points in the Mt. Pleasant-Centerville district, to Clyffside, Normal and Catlettsburg, Ky., Kenova and Huntington, W. Va. Present rate, 558c per net ton. Proposed rate on the above named commodity from and to the above named points, 440c.

ILLINOIS FREIGHT ASSOCIATION
DOCKET

6338. **Gravel**, carloads, usual minimum weight, from Ottawa, Ill., to Cordova, Ill., applicable only on Illinois intrastate traffic. Present, combination rates. Proposed, \$1.25 per net ton.

6358. **Gravel or sand (common river)**, (See Note 3), but not less than 40,000 lb., from Mt. Carmel, Ill., to Southern Ry. stations in Illinois. Rates per net ton:

To	Pres. Prop.	To	Pres. Prop.		
Browns	65	60	Golden Gate	65	60
Albion	65	60	Merriam	76	65
Ellery	65	60	Fairfield	78	65

SOUTHWESTERN FREIGHT BUREAU
DOCKET

23733. Asphalt rock, natural or coated, also stone and chaff (mine gravel), coated, from, to, and between southwestern points. To establish the following commodity description in Item 5, S.W.L. Tariff 162B, applying from, to and between points in territory included in Items 100, 105 and 120 of that tariff, subject to restrictions therein applicable in connection with rate bases 10 and 11.

It is stated that the present use of the term road oil is inexact and as this commodity is nothing more than asphalt, a petroleum product, the substitution of the word "asphalt" is suggested for the words "road oil." It is pointed out that various lines use the term "asphalt coated crushed stone" in their tariffs and that although they mostly agree that this commodity is the same as described in S. W. L. Tariff 162D, they decline to cancel the rates unless the description in the latter tariff is corrected. It is believed that since asphalt coated chaff is carried on same basis as coated stone in the various individual issues, that it should be included in S. W. L. Tariff 162D on same basis as coated stone.

WESTERN TRUNK LINE DOCKET

7383-C. Limestone, agricultural (for land fertilizer purposes only), carloads (See Note 3). In no case shall the minimum weight be less than 40,000 lb. From Rock Hill, Mo., to points in Missouri. Rates: Present—Crushed stone rates as shown in Items 145-E, 925-C, W. T. L. Tariff 91-F. Proposed—Propose to add Rock Hill, Mo., a local point on the Missouri Pacific, as a point of origin in Item 1105-H of Western Trunk Line Tariff 91-F. (By shipper.)

496-S. Limestone, agricultural, ground or pulverized, in bags, barrels or in bulk, for soil treatment, carloads (See Note 2), from St. Joseph, Mo., to stations on the C. R. I. & P. Ry. in Iowa. Present rates, class "E"; proposed, mileage scale of rates, of which the following are representative, rates per net ton:

Miles	Cents	Miles	Cents
50.	63	300.	165
100.	88	400.	195
200.	135	500.	225

(Complete copy of exhibit will be furnished on request.)

7418. Chaffs, stone, crushed, gravel, tailings, lead or zinc, cinders, carloads, from K. C. S. stations, viz., Athletic Spur, Byrd Spur, Chat Junction, Princess Spur, Taborwood Spur, Mo., to A. T. & S. F. stations in Kansas as follows: Turner, Morris, Holliday, Zarah, Craig, Snow, Olathe. Please refer to Docket Bulletin No. 2813, dated October 13, 1930. Docket No. 7418. This subject has now been canceled from the docket.

I. C. C. Decisions

23157. **Sand and Gravel**. The Smoot Sand and Gravel Corporation vs. B. & O. et al. The order entered by the Commission herein June 5, is modified to become effective December 14, only in so far as the said order requires the removal of undue prejudice to Georgetown, D. C., respecting the rates to Derwood, Md., and Mt. Airy, Md., and points east thereof on line of the B. & O. within the destination territory described in said order.

Proposed I. C. C. Decisions

24606. **Crushed Limestone**. Shelby county commissioners vs. M. P. et al. by Examiner T. Naftalin. Dismissal of rates proposed. Rate, crushed limestone, Krause, Ill., to Capleville, Tenn., applicable and not unreasonable.

24587. **Crude Ground Talc**. Traffic Bureau, Lynchburg Chamber of Commerce, vs. C. & O. et al. by Examiner Paul R. Naefe. Carload, crude ground talc, Emery-

ville, N. Y., to Lynchburg, Va., misrouted by the New York Central. Applicable rate over route of movement not unreasonable, but applicable over the route shipment should have moved unreasonable to the extent it exceeded 36.5c. Reparation of \$32.40 proposed.

Many Exceptions Filed to
Proposed Industrial
Sand Rates

THE EFFORTS of Interstate Commerce Commission Examiner Burton Fuller to formulate a uniform scale of freight rates on industrial sand between points in official classification territories are meeting with a storm of protest from shippers of sand throughout that section of the country.

More than a score of exceptions have been filed with the commission to Examiner Fuller's proposed report, which covered about 30 separate cases involving rates on sand and related articles which he grouped together as "Industrial Sand Cases, 1930." Because of the number of these exceptions it would be impossible to give a summary of them or to attempt to detail the arguments used.

One exception, however, which made interesting reading to anyone interested in the cases, was filed by the Illinois Silica Sand Traffic Bureau.

This brief declared Examiner Fuller's report was unreasonable, contrary to law and the weight of evidence. The Illinois association admitted that "the issue is an aggravated one and one of long standing" and that "we are fully cognizant of the difficulties with which the examiner is beset in the preparation of a report in rate proceedings of this nature where the facts are many and controverted and there is more or less confusion as concerns the issues."

Protest was made by the Illinois association against Examiner Fuller's suggestion for a different basis of rates on industrial sand than on common building sand. This suggestion, the brief said, is "a very drastic departure from the practices of the past, the wisdom whereof is still be weighed in the balance of time."

The record in the case is barren of essential testimony and evidence of a probative value on which the examiner could suggest a segregation of ground or pulverized sand from other types of industrial sand; to classify ground or pulverized sand with amorphous silica, clay, flint or tripoli, and to determine class or column 16 rates as an appropriate rate level for future application to this traffic, the brief said.

"If in its wisdom the commission should entertain any idea as to the propriety of a segregation of ground or pulverized industrial sand on the one hand from unground industrial sand on the other, then it is this complainant's conviction that these proceedings in so far as they are pertinent to that issue should be reopened for the purpose of making an adequate record of essential facts

and permitting affected interests to be heard in connection therewith."

In the interim, the brief suggested, the commission should reserve judgment and permit ground or pulverized sand to continue to be associated with and enjoy the same rate level as is applied to other unground industrial sands, as it always has in the past, "until such time as the wisdom of the termination of that policy has been definitely and conclusively established."

Concluding its argument, the Illinois association declared that adoption by the commission of the examiner's report would result in an adjustment of rates far more chaotic than that now prevailing.

"Indeed," the brief said, "it is the opinion of this complainant that the interests of the parties concerned in this proceedings would be best served if the tentative report was rejected in its entirety and a new report proposed by the examiner."

Discrimination in Virginia Sand
and Gravel Rates Alleged

ALLEGING discrimination in favor of competitors located in Virginia, the East Tennessee Sand and Gravel Co., Elizabethton, Tenn., has filed formal complaint with the Interstate Commerce Commission against the Southern railway attacking freight rates on sand and gravel, in carloads, from Elizabethton to various points in Virginia.

The destination territory specifically mentioned in the complaint lies south and west of Roanoke, Va.; between Norton and Bristol, Va., on the west and Roanoke on the east; to all stations on the main and branch lines of the Norfolk and Western railway, and to all stations on the branch and main lines of the same road west of Petersburg, Va.

The rates involved, according to the complaint, are substantially higher than the docket 17517 scale of rates prescribed by the commission and considerably higher than the current freight rates on the same commodities charged competitors of the complainant in Virginia.

The commission is asked to prescribe just and reasonable rates for the future and to award reparation.

Continue Mississippi Sand and
Gravel Rate Case

THE sand and gravel rate cases were again continued by the Mississippi Railroad Commission at its November session.

The railroads have petitioned the Interstate Commerce Commission for higher rates on sand, gravel and other road aggregates, asking that the present intrastate rate in Mississippi be declared illegal and prejudicial to interstate shippers.—*Rolling Fork (Miss.) Pilot*.

Supreme Court Upholds I. C. C. Rate Ruling on Sand and Gravel

THE SUPREME COURT of the United States, November 24, in Nos. 36 and 37, Louisiana Public Service Commission et al., appellants, vs. the Texas and New Orleans Railroad et al., and the State of Louisiana and Louisiana Public Service Commission, appellants, vs. United States of America, Interstate Commerce Commission et al., in an opinion delivered by Justice Butler, affirmed the district court of the United States for the eastern district of Louisiana, thus upholding the rates prescribed by the Interstate Commerce Commission in 155 I. C. C. 247 and 157 I. C. C. 498, on sand, gravel and other road materials, in Arkansas, Oklahoma, Texas and that part of Louisiana west of the Mississippi, including certain points on the east bank of the river, for interstate and intrastate transportation.

The commissions of Arkansas, Oklahoma and Texas adopted for application therein the intrastate rates prescribed. The carriers, continued the justice, applied to the Louisiana commission for authority to give them effect in that state. On October 12, 1929, the commission adopted them, said the justice, as to traffic between points on and north of the Vicksburg, Shreveport and Pacific railroad and between that territory and points in western Louisiana south of the railroad. It refused to apply them on traffic wholly within the territory south of the railroad or on the traffic between that part of the state and the specified places on the east bank of the river. The first of the suits was brought by the carriers against the commission and its members to enjoin them from interfering with the application of the intrastate rates, and the other was brought by the state and the commission to annul them. A court of three judges heard the cases, held the rates valid, granted a permanent injunction in the first suit, and dismissed the other.

Justice Butler pointed out that Congress had empowered the commission to prescribe intrastate rates in place of those found unduly to discriminate against persons or localities in interstate commerce or against that commerce, and to require the carriers to make and apply on intrastate transportation such reasonable charges as would produce its fair share of the amounts needed to pay operating expenses, provide an adequate railway system, and yield a reasonable rate of return on the value of the property used in the transportation service.

The court said producers outside Louisiana were necessarily at disadvantage in respect of the sale and delivery within that state of materials to the extent that the state rates were lower than the prescribed scale. It said the facts as stated by the commission were adequately supported by the evidence and were clearly sufficient to warrant the commission in prescribing the schedule of intrastate rates under consideration.

Oppose Change in Weight Tolerance Rule

PROPOSAL of the railroads of the United States to establish a uniform weight tolerance rule to govern reweighing of carload shipments has been suspended by the Interstate Commerce Commission until August 1, 1932. The proposed rule was published in B. T. Jones' Tariff I. C. C. 2434 and F. L. Speiden's Tariff I. C. C. 1475.

The rule would affect shipments of clay, dolomite, ore, sand, slag, all stone (not cut), brick, and similar commodities.

The present rule provides that tolerance on these commodities shall be 1% of the lading, with a minimum of 500 lb., except when the shipments are loaded in open-top cars, when it should be 1% of the lading, with a minimum of 1000 lb.

The proposed rule would change the tolerance when shipments are loaded in open-top equipment to 1½% of the lading, with a minimum of 500 lb.

Protest against the proposed rule was filed by the Indiana State Chamber of Commerce and the National Industrial Traffic League.

I. C. C. Sets Aside All Pending Rate Orders in South Carolina

THE Interstate Commerce Commission has handed down an order in the matter of rates on sand, gravel and crushed stone in the state of South Carolina, setting aside all orders heretofore issued in this case, especially that under date of July 14, 1931, to become effective November 30, 1931. It declared that none of these would become operative until further notice of the commission.

The commission ordered some time ago that intrastate rates on the products named should be on a level with those of an interstate kind, and the South Carolina railroad commission and producers have been endeavoring to have the commission revoke it.—*Columbia (S. C.) State*.

Rules Cyanamid Rates Unreasonable

THE Interstate Commerce Commission has sustained the complaint of the American Cyanamid Co. against railroads generally and held as unreasonable rates on cyanamid from Niagara Falls, Ont., Canada, to destinations in central and southern territories.

The decision awards reparation for overcharges on past shipments.—*Wall Street (N. Y.) Journal*.

New Slag Plant

THE NEW SLAG PLANT at Bessemer, Ala., built by the Roquemore Gravel Co., Montgomery, Ala., has been completed and placed in operation. The first shipment of slag was made on November 14. This plant was reported in the October 10 issue of Rock Products.

Soil Improvement Trains Develop Use of Agricultural Limestone

PRACTICAL RESULTS from the operation of soil improvement trains in the rural communities of Quebec by the Canadian National Railways and the provincial government are shown in a survey which has just been completed by the agricultural department of the railway. Since 1928, emphasis on the importance of improving the physical condition of Quebec soils, particularly through the use of domestic agricultural limestone, has been placed by the experts in charge of the trains. As a practical demonstration to the farmers, no less than 12,000 separate samples of Quebec farm soils were tested, and of these over 70% were shown to be suffering from excess acidity.

Use of Quebec crushed limestone to correct this condition has been strongly recommended, with the result that the amount of this commodity moved over the railways for the use of farmers showed an increase of 400% between 1928 and 1930. In 1928 only 4628 tons of limestone were moved for this purpose in the province of Quebec. This year up to the end of November, 21,000 tons had been handled or contracted for, and by the end of the year the figure will probably be in the neighborhood of 25,000 tons.

Through the efforts of the Canadian National Railway's department of agriculture and the cooperation of the provincial officials, limestone intended for soil improvement in the province is now moved over the railway from points in Quebec at special rates and the cost of limestone to the farmer at the quarries has been further reduced. Quebec farmers, to enjoy these special privileges, have but to obtain a permit from the local agricultural agent to show that the limestone is to be used on the land.

All supplies under the present scheme come from various quarries in the province of Quebec, the principal ones being those of St. Mark, Hull and Joliette.

To Reorganize Texas Glass Plant

THE TEXAS GLASS CO., west Texas' only glass plant, is to be reorganized and its capital stock of \$100,000 doubled, making it the biggest glass plant in the state.

The old Santa Anna mountain hides under 12 ft. of clay one of the best deposits of glass sand, or silica, 98.5% pure, and only 50c. a ton haul from the plant between Pampa, Tex., and Bangs.

There is enough sand in the mountain to furnish glass materials for many years, experts estimate, and in recent seasons 4500 carloads of sand have been shipped to other glass plants, some to Monterrey, Mexico. Gas is available for the plant at 10c. per 1000 cu. ft., with plenty of labor and cheap operating costs.—*Pampa (Tex.) News*.

Foreign Abstracts and Patent Review

Four New Processes for Improved Cement. W. Marschner gives results obtained with four recently patented processes which are intended to produce an improved cement. In the process of the Budern Eisenwerke, Wetzlar a. d. Lahn for increasing the strength of cement, dust from blast furnace gas is added to the raw flour in the following manner: the blast furnace gas dust (blast furnace gas slurry) which has been precipitated by wet cleaning in centrifugal or other devices is dried at a temperature of not higher than 300 deg. C. and mixed with the cement. If the blast furnace gas slurry is dried at a temperature above 300 deg. C. it loses its hydraulic properties. The results as shown in the accompanying table were obtained with this cement.

The process of Gewerkschaft Claudio, Grossenbaum by Duisburg, is to produce early setting and an improved cement. By adding barium chloride to the mixing water the 2 to 3% of gypsum added to the cement as it leaves the kiln is converted into harmless barium sulphate, according to the reaction:



The gypsum is thus eliminated, giving the cement rapid set and at the same time calcium chloride is formed, which also accelerates the set. Barium chloride is used because the adding of calcium chloride reacted differently in different kinds of cement, making calcium chloride non-dependable. During freezing weather it is suitable to add also calcium chloride to the mixing water, which increases strength further.

In the process of Pontoppidan and Buntzen, Denmark, it is stated that when gypsum has been added to cement in quantities of 2% to 3%, or up to 12% if the cement contains slag, it results in an irregular time of set; this is due primarily to thermic conditions in the mill, with the result that at one time gypsum prevails in the raw state and at another time in a burned state in the finished cement. If the gypsum is added raw to fine-ground fresh portland cement, the time of set is much longer, frequently 500%, than if the gypsum occurs as a semi-hydrate; and dead-burned gypsum lengthens the time of set also. It is therefore best to have the gypsum in the cement either raw or dead burned. In order to effect this condition during grinding of cement clinker and gypsum, the mill may be cooled in a suitable manner to prevent the raw gypsum from being heated to a temperature at which it changes to a semi-hydrate (at about 107 deg. C.). However, the clinker may be brought to the suitable low temperature before grinding, for example, by artificially cooled air. Another method is to grind the

Mixture in parts	Time of set hours	min.	Kg. per sq. cm. compressive strength after:			
			1 day damp air	3 days water	7 days water	28 days air
1 Iron portland	3	20	107	253	377	515.3
3 Normal sand						574
1 Iron portland	3	45	114	326	567	772
3 Normal sand						860
1 Iron portland	5	30	97	297	598	848
3 Normal sand						933
10% Dried gas slurry						

raw gypsum and the sufficiently cooled cement separately and then mix them; and another method is to effect a dead burn of the gypsum before or during its mixing with the cement.

Then the author describes the process of the International Cement Corp., New York City, for the production of improved portland cement, in which he compares the strengths of the Durbin [International's "Incor" patent] cement with the standard portlands made at the Knickerbocker and Houston plants. This cement contains only the highest stages of lime, the compounds of silicic acid, lime-alumina and lime-ferric oxide, using the formula $\text{CaO} (1.65 \text{ Al}_2\text{O}_3 + 1.05 \text{ Fe}_2\text{O}_3 + 0.7 \text{ SO}_3 = <2.8 \text{ SiO}_2)$.—*Tonindustrie-Zeitung* (1931) 55, 34, pp. 493-496.

Reclaiming CO₂ Gases from Lime or Cement Kilns. J. Deforge discusses the sources and amount of CO₂ found in the

waste gases from lime and cement kilns. He describes in a general way the equipment necessary for the collection, purification, compression and utilization of the CO₂ gas, including some figures on size and some operating details. A relative diagram of a CO₂ recovery plant is shown in Fig. 1: (1) arrangement of the modern kiln; (2) the cover or sealing zone of the kiln throat; (3) vertical stack; (4) the chimney damper of the draft stack, which should remain closed; (5) the automatic drawing grate; (6) the drawing hopper; (7) the first gate; (8) the second gate; (9) the fan; (10) the dust and cinder filter; (11) the water-circulating stage washer filled with coke or with pebbles; (12) the water filter and vessel for aspiration of the gas pump; (13) the aspirating and forcing pump compressor; and (14) the apparatus in which the CO₂ is utilized or where, as conditions require, it is separated from the nitrogen and other inert gases. This equipment varies in design, size and

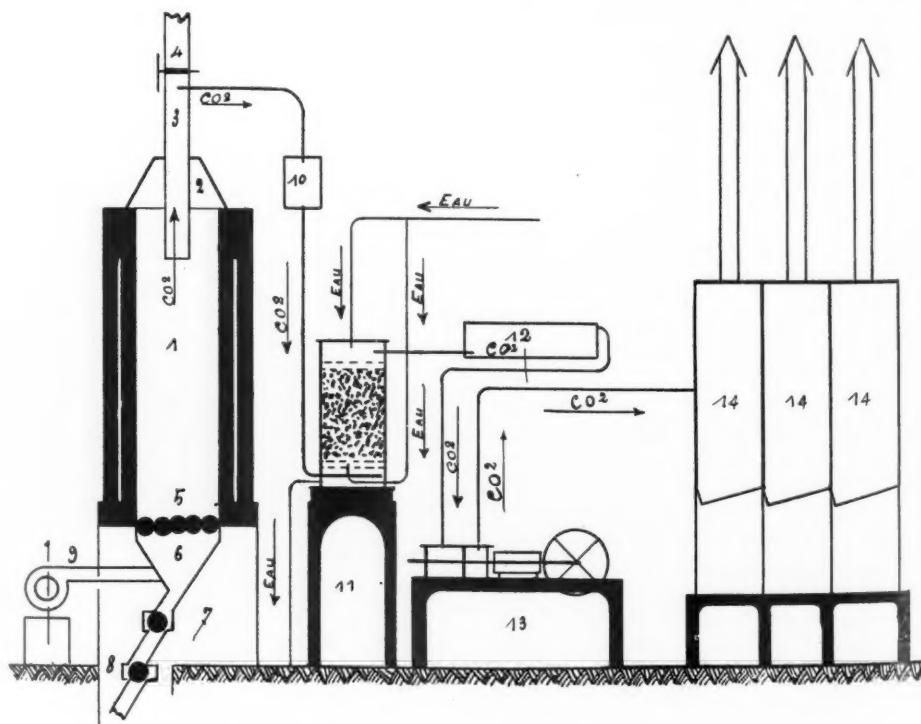


Fig. 1. Relative diagram of CO₂ recovery plant

other conditions to meet the requirements of various plants.—*Revue des Materiaux de Construction et de Travaux Publics* (1931) 259, pp. 133-138.

Determination of Free Lime. K. Schindler discusses and supplements the glycerin-tartaric acid method of H. Rathke (*Tonindustrie-Zeitung*, 1928, p. 1318). Rathke applied this method to the quantitative determination of free lime and hydrate of lime, and also of hydrolyzable lime combinations, as a variation and improvement of the well-known Emley method. Rathke prefers the use of alcoholic tartaric-acid solution to the use of alcoholic ammonium acetate solution used by Emley. K. Schindler points out various conditions in the Rathke method which, if not known, might lead to erroneous results.—*Zement* (1931) 20, 17, pp. 389-390.

Recent Process Patents

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Commissioner of Patents, Washington, D. C., for each patent desired.

Sand Mold Facing. The patentee proposes to use finely pulverized slag as a coating for iron or steel foundry molds. The slag can be dusted on dry or in the form of a thick slurry. The author claims that when the molten iron or steel is poured into such a prepared mold the slag first melts and coats the interior of the sand mold with a smooth gloss, thus producing smoother castings than would be the case were the slag not used. *Clyde C. DeWitt*, July 15, 1930. U. S. Patent No. 1,770,684

Process for Making Portland Cement. An "improved mixture" for making portland cement has from 10% to 50% of unground portland cement clinker mixed with the usual raw materials and ground with them

to the necessary fineness. This mixture is then burned in the usual way. It is to be noted that the portland cement clinker is added in the unground state. Another patent (Colton's) covers the addition of ground clinker to the ground raw mix.—*Guy S. La Forge*, U. S. Patent No. 1,784,840.

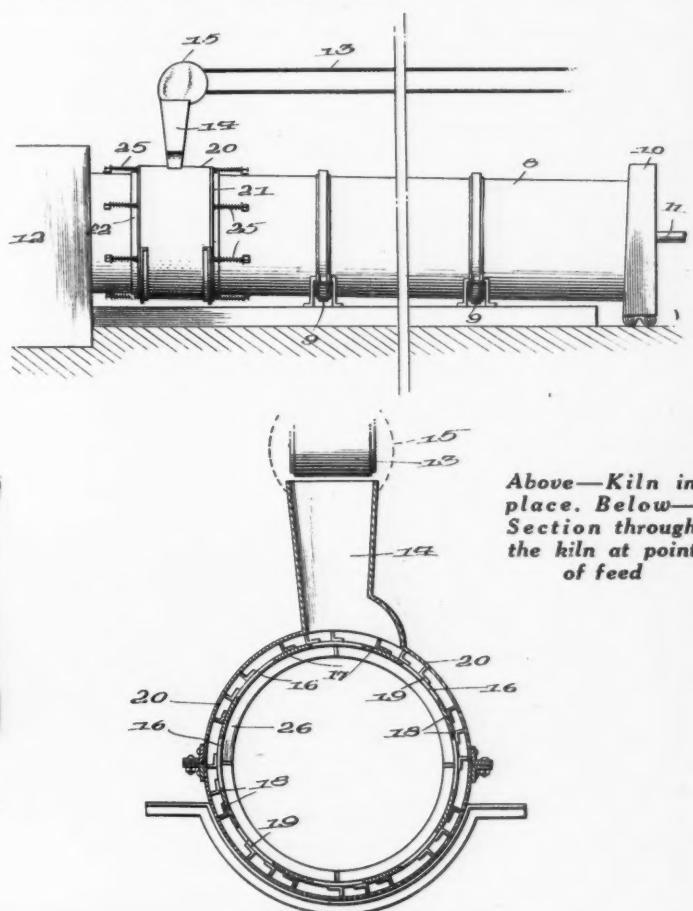
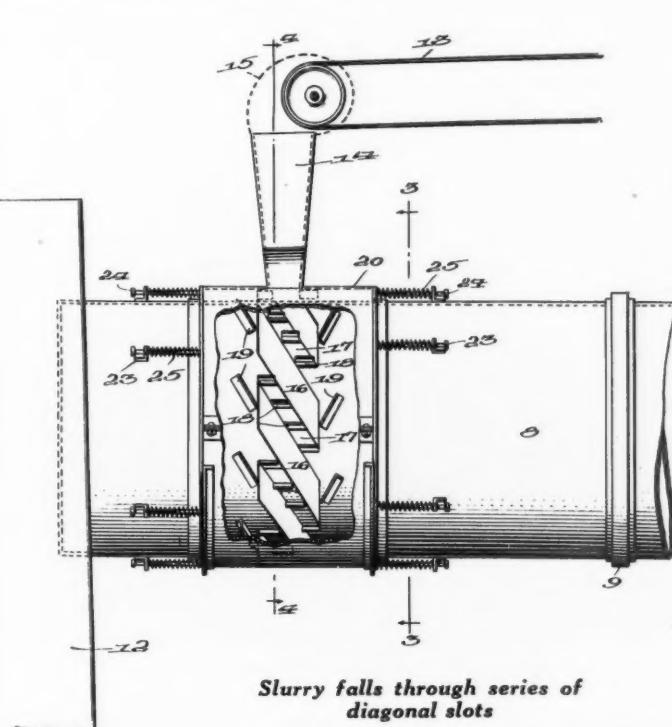
Feeding Slurry Filter Cake. A method of feeding slurry has been devised which is especially adapted to feeding the cake formed by filtering cement raw mix slurry. There is a small hopper above the kiln to which the slurry is brought by a conveyor belt. Below the mouth of the hopper the kiln is pierced with a series of diagonal slots which pass under the hopper mouth as the kiln turns, and, being set on the diagonal, there is always an opening through which the slurry may fall. The spaces between the slots carry angle irons. Other angle irons are placed on the shell at the sides of the slots. These vanes of angle iron carry the slurry forward as well as helping to break up the cake. The portion of the kiln which has these diagonal slots is surrounded with a stationary cylinder to act as a seal. A pair of faced angle iron circles which are held in contact by springs keep the seal tight.—*Haavard Kronstadt*, assignor to the Bessemer Cement Corp., U. S. Patent No. 1,793,408.

(Note—This type of feeder is in use. A recent installation is at the Arkansas Portland Cement Co.'s plant, described in Rock PRODUCTS for March 28. The feeder was followed with 20 ft. of a spiral made of cast iron lifters.—Editor.)

Making Cement from Phosphatic Limestones and Marls. There are limestones, slags and marls in the United States that might be used for cement if they did not contain small amounts of phosphoric acid. The inventor of a process for using these materials says that cement has never been made from them commercially, although they were tried at one factory which had afterward to bring in phosphorous free materials from a distance. With as little as 1.5% of P_2O_5 in the raw mix, the clinkering temperature is raised to 1500 deg. C., which is hard to attain in a rotary kiln. He claims that by the use of a "mineralizer" he can convert the P_2O_5 present in the limestone or marl to harmless ferric phosphates, the proportion being about 1.1 parts of ferric oxide for 1 part of P_2O_5 , where an iron compound is used. A "mineralizer" is defined as a compound that stimulates the formation of definite mineral entities.

Details are given of a test of cement making from phosphatic marl and clay, the raw mix containing 1.6% P_2O_5 . Without adding Fe_2O_3 the clinker contained 4.5% of free lime and when finely ground was very unsatisfactory as cement. After reburning at 1500 deg. C. it still contained 0.5% free lime and was only fair in quality. When 1.2% Fe_2O_3 was added it was burned to a clinker that made an excellent cement at 1400 deg. C.

It is suggested that the iron may be added as ferrous carbonate ore, roasted pyrites, rolling-mill scale and clays and shales rich in iron.—*Frederick W. Huber*, U. S. Patent No. 1,781,232.



Gypsum, Lime and Alabastine, Ltd., Adds Two New Products

TWO NEW PRODUCTS to be manufactured at the South Westminster, British Columbia, plant of Gypsum, Lime and Alabastine of Canada, Ltd., are expected to stimulate business for the company in the near future, according to Norman Jessiman, British Columbia manager. The new products, Mr. Jessiman stated, are a gypsum wall board with wood grain finish and a new acoustic tile. The entire process of manufacture of the new materials will be carried out at the local plant.

The company maintains a research laboratory and the products, Mr. Jessiman stated when interviewed, had been developed by that department.

The South Westminster plant has been working steadily for the past two weeks. Every effort is being made, both Mr. Jessiman and A. L. Dryden, plant superintendent, stated, to spread the available employment over the regular employes by rotating the work.

It has been the export business of the company that has suffered during the depression, according to Mr. Jessiman. The domestic business has been satisfactory and has offered no reason for complaint. The company's various specialties have assisted materially in maintaining operations when the demand for the standard products was somewhat reduced.

There is only one of the numerous products of Gypsum, Lime and Alabastine of Canada, Ltd., that is not produced at the South Westminster factory. That is alabastine. All the others can be made there and the plant supplies the domestic demand for these and is also responsible for large export shipments.—*New Westminster (B. C.) British Columbian*.

General Material Co. Reports Record Business

DELIVERIES of Red-D-Mix concrete by the General Material Co., St. Louis, Mo., in October totaled 35,200 cu. yd.—the largest quantity in any month in its history. Also, October 21 showed the largest single day's deliveries since the Red-D-Mix service was established in 1927—2,445 cu. yd.

Setting up such records in a year when local construction is far from a peak, is of real interest at this time. These quantities represent the handling and distribution in the form of ready-mixed concrete, of approximately 100 carloads of material per day over several days in succession.

A steadily increasing number of contractors are taking advantage of the speed, convenience, and guarantee of superior quality represented by Red-D-Mix for all character of concrete work, the company reports.

Rock Hill Quarries Co. Abandons Missouri Gold Mining Venture

GOLD MINING operations in St. Louis county, Mo., looked forward to last July somewhat hopefully, have been abandoned by the Rock Hill Quarries Co., which took options on 1000 acres of land near Allentown, in the southwestern part of the county.

Encouraged by reports of metallurgists who assayed samples ranging from nothing to \$24,624 a ton, the company signed with four farmers on a royalty, lease and bonus basis on condition that samples would pan out a sufficient quantity of gold to justify mining. Three 50-lb. samples were taken from each of the farms and sent to government mining bureaus. The reports showed gold worth \$4 a ton of material, which is considerably less than the cost of mining it, according to Henry Billman, president of the quarries.

Not satisfied with the government reports, the company brought a metallurgist here from New York. He took samples and agreed with the government. Mr. Billman, after announcing that the company would not exercise its options, described the gold-mining adventure as "a chance worth taking."—*St. Louis (Mo.) Post-Dispatch*.

Organize Company to Manufacture Asbestos Products in Indiana

WITHIN the next few weeks Wabash, Ind., will have in operation a company manufacturing asbestos products. Full details of the establishment of the concern will be announced later.

The new factory is to be known as the "Decelerite Corp." and those financially interested are William M. Callahan and R. M. Watkins, Buffalo, and Guy Calhoun, Wabash. Both Mr. Callahan and Mr. Calhoun were connected with the former Midland plant.

The Mikesell plant has been purchased by Mr. Callahan and his associates. In the near future there will be a meeting of those interested and organization will be made with election of officers.

At present the interior of the plant is being cleaned and renovated and some changes will be made both in the plant proper and in the offices.—*Wabash (Ind.) Star*.

United States Gypsum Co. Subscribes to Emergency Fund

AGIFT of \$30,178 to the Cook county joint emergency relief fund has been made by the United States Gypsum Co., Chicago, Ill.

The employes subscribed \$15,089 and the company subscribed a like amount.

Plans Mill for Grinding Mica in Colorado

J. W. MAGNUSON, president and general manager of the Western Mica and Feldspar Co. of Denver, Colo., conferred with officials of the Denver and Rio Grande railroad recently in relation to a concession from the company for a site west of Soda Point, upon which to build a mill for grinding mica and feldspar and for the preparation and shipment of its products to market.

Mr. Magnuson and his business associates have recently purchased the Robert A. Shipley mica claim, better known as the Halsted claim, four miles west of Canon City, and are planning to develop it on a commercial scale. The output of this property, it is understood, will be marketed from the plant he is desirous of erecting.

Mr. Magnuson's plans are for an establishment capable of handling a large tonnage of mica and other valuable nonmetallics. He has, it is understood, reached agreements with both the Denver and Rio Grande Western and the Santa Fe freight departments as to shipment charges.

The mica and feldspar resources of the western portion of Fremont county are unexcelled elsewhere in the country, according to geological reports.—*Canon City (Colo.) Record*.

State Considers 1932 Cement Contracts

THE Indiana state highway department had under consideration bids which have been received on cement to be used in the highway program next year.

The commission met November 24 and although it was reported that it would discuss the changing of the present system of receiving bids on cement and permit the contractors themselves to buy it, no action was taken.

This may be done at the next meeting of the commission, it was said, but not until after the present contracts have been awarded, according to Ralph E. Simpson, assistant to the director of the highway department.—*Indianapolis (Ind.) News*.

Issues Invitation to Ready-Mixed Concrete Association Convention

INVITATIONS to the National Ready-Mixed Concrete Association convention, and a reminder of the meetings of the National Crushed Stone Association and the National Sand and Gravel conventions, all to be held in Pittsburgh, Penn., during the latter part of January, have been mailed by the Pittsburgh Chamber of Commerce.

The invitation contains interesting information regarding the city and views of points of interest.

Cuban Cement Mill Wins in War on Accidents

Spanish Speaking Employees, Against Many Handicaps, Organize and Secure Results

ACCIDENT PREVENTION has become the "hobby" in almost every cement mill in North America where the English language is spoken. The remarkable record of the Cuban Portland Cement Corp. at its plant at Cayo Mason, near Havana, during the last two years indicates that Spanish-

inspections were conducted each week, one at the beginning, the other at the end. Each subcommittee inspected the three departments represented in its membership.

(3) Following the inspection at the beginning of the week a report was made, covering conditions in the three departments

it would always be possible to have a trained man on duty in each department and near at hand no matter where an accident might occur. All members were expected to attend weekly training and practice periods.

(7) A monthly safety bulletin was published in Spanish and distributed among all employees.

Organization Well Carried Out

Reports indicate that the entire plan outlined above was followed carefully. The general committee and its subcommittee were appointed and made acquainted with their work prior to January 1. The line-up was as follows:

Subcommittee 1—J. Krog-Jensen (laboratory), J. O. Johnsn, (waste heat), E. M. Burg (mill).

Subcommittee 2—H. C. Lewis (quarry and crushing), N. Perez (machine shop), John Rae (superintendent).

Subcommittee 3—A. M. Fernblom (construction), C. M. MacGregor (office), A. Puga (packing and yard).

Subcommittee 4—J. A. Soltura (power plant), A. L. Gomez (secretary), F. Puissegur (electrician).

The "log" of subcommittee activities reveals many interesting points. Subcommittee 1 took up its duties on January 3, 1930, and completed its first inspection and report on January 10. The report was as follows:

"REPORT OF INSPECTIONS FOR WEEK JANUARY 3-10, 1930"

Subcommittee 1

In order to further improve safety conditions in this department the following points should receive attention:

Waste Heat Department

1. The flue gas fans have unguarded couplings. The 2300-volt leads should be pro-



Safety committee of Cuban Portland Cement Co. in 1930

speaking workmen are equally interested and in this particular case have hung up a safety record seldom matched. In at least one respect it is unique, for during 1930 the Cuban plant worked more man-hours than were ever before worked during a calendar year by any cement mill without loss of time or serious injury.

The International Cement Corp., of which the Cuban corporation is a subsidiary, has made accident prevention a prominent feature of its operating program for a number of years, and prior to 1930 very commendable progress was made in the reduction of employee injuries. Late in 1929, Superintendent John Rae and his safety committee, convinced that a well-organized effort would carry the plant through the year with a perfect record, developed a remarkably complete program of safety work for the following year.

The plan combined a number of features of proven worth with several others not found in common practice in the cement industry. Following are the more important:

(1) General mill safety committee of 12 members, of which the superintendent acted as chairman and on which all of the departments were represented, was divided into four subcommittees of three men each.

(2) The four subcommittees rotated each week in conducting safety inspections. Two

visited, findings of the subcommittee, and recommendations. After the week-end inspection the subcommittee makes a final report, ascertaining first that its recommendations have been complied with.

(4) The above arrangement provides for these two detailed inspections of each department each month. One member of each subcommittee then joins a select committee of four which conducts a general inspection of all departments at the end of the month. All of the reports are reviewed and discussed by the general committee.

(5) A mass meeting was provided for on or about the first of each month, with programs including speeches, displays and first-aid demonstrations. Each mass meeting was in charge of a different department, one rotation of the twelve departments providing programs for one year.

(6) A first-aid class was organized. A man was selected from each shift in each department to join the class so that



A monthly safety meeting



Departments lined up to collect safety bonus

tected. A guard rail between the columns is proposed in order to prevent free entrance to the motors.

2. A 2300-volt transformer bank is unguarded on the operating floor.



Safety bulletin board

3. The hand rail between No. 4 and No. 5 dust chambers is broken and should be repaired.

Mill Department

1. In raw mill, a projecting set screw was found on kiln feeder trough screw conveyor coupling; countersunk set screw should be used.

2. Guard rail needed on top of kiln feed trough to safeguard men as they tend ferris wheel feeders.

3. Unguarded belting on several slurry tanks driving agitators and elevators. It would be very difficult to guard this belting fully owing to the necessity for men to pass under and around it for tank inspection. Therefore speed reducers are suggested as probably offering remedy for the situation.

4. Lack of rail on oiling platform over raw Hercules mill No. 3.

5. Loose stair rail on No. 3 pug mill hopper gives false assurance of safety.

6. Driving belts on Williams mill and crusher should be guarded, also those on inclined belt conveyor to Williams mill hopper.

7. Floor around feed end of inclined belt should be made complete, and preferably of subway grating instead of wood. Two narrow steps leading down to the floor assure nasty fall for the stumbler.

Kiln Department

1. Railway missing between kilns 5 and 6.

on kiln floor; this should be replaced at once.

2. Wooden cover plate on manhole at top of clinker silo should be replaced by sheet iron plate.

Finish Mill

1. Skipulter flywheel, on second floor, should be guarded; hand rail sufficient.

2. There is no guard on gypsum elevator belt drive.

3. A projecting plate was noticed on coupling of No. 2 Hercules mill. This was corrected immediately.

4. Guard rails on platform over Hercules mill No. 1 weakened by being cut in two between stanchions.

5. Guard on belt drive of dust exhaust fan removed for motor repair and not replaced.



Ten reasons for safety to this workman

6. Chain drives on dust collector rapping device should be enclosed by metal guards.

Conclusion

Inspection revealed only one major hazard: The lack of a hand rail around oiling platform over Hercules mill No. 3, raw end. Other details needing attention were for the most part guards on belt drives. This condition, while not actually dangerous under normal circumstances, should be corrected in order to assure safety under all combinations of thoughtlessness and conditions.

Signed by the Committee

Superintendent Rae approved this report and sent copies of it immediately to all department heads with the following letter of transmittal:

To All Foremen:

The recommendations proposed by subcommittee 1 on attached report of their inspection are approved, and items pertaining to work to be carried out by your department should have the earliest possible attention.

JOHN RAE,
Superintendent.

Subcommittee 2 Reports

A corresponding report by subcommittee 2 impresses one equally with the thorough nature of the inspection and the number of small hazards which can be discovered by such a plan, even in a plant where accident prevention has had serious attention previously. A typical report of subcommittee 2 is as follows:

REPORT OF INSPECTIONS FOR WEEK FEBRUARY 1-8, 1930

Subcommittee 2

Quarry

1. Angle hand rail on east side of track, opposite McCully crusher, should be renewed and should also be extended 5 ft. further on each end.

2. Broken guard around McCully crusher should be repaired, or replaced with pipe or angle iron railing.

3. More warning signs should be installed for those not familiar with blasting and general quarry operations and signals.

4. Quarry foreman should warn his men constantly to keep clear of cars while loading and to beware of rock falling from moving trains.

5. Tree roots were found growing through stones on the face of the quarry and breaking them away at intervals. Boulders should be removed before there is danger of their falling away, with consequent chance for personal injury or property damage.

6. Gate to dynamite house should be locked at all times.

7. Broken rail at top of clay building dump should be repaired.

8. Warning signs should be erected ordering persons to keep clear of bottom of car



A constant reminder of danger

dump in order to afford protection against possible stray fragments.

9. Men on hammer mills should discontinue practice of poking down wet material when mills are in motion.

10. All power wiring being overhead, it

should be inspected daily to prevent or detect falling post or wire.

Machine Shop

1. When it is not feasible to put up guards around belts, men should be frequently warned by foreman.

2. A piece of machinery in for repair was standing with the heavy portion on top so that a slight push might have upset it with injury to persons near it.

3. Care is advised in firmly attaching work to bed of drill presses.

4. Men should be warned to observe every possible care in handling oxygen and acetylene bottles, refraining from smoking while handling hoses and inspecting all connections with utmost care before using.

5. Outside construction jobs by this department should be planned to insure safety. Scaffolds and platforms should have particular attention. There is good food for thought in the knowledge that all accidents suffered by this department have come from construction work.

The report was signed by members of the subcommittee and as in the previous case it was approved by the superintendent and all details promptly taken care of. Through the entire series of 48 reports rendered by four subcommittees careful attention was given to the minute and detailed causes of little accidents and near accidents—the organization being convinced that to prevent a near accident is to sidestep a fatality tomorrow.

Sidelights on the Safety Campaign

It will be readily understood that in organizing its safety campaign the Cuban Portland Cement Corp. faced many obstacles not encountered by the average industry located in the United States. The safety movement is not so far advanced there and much pioneer work had to be done in interesting the workmen. Relatively little on industrial safety has appeared in Spanish and therefore it has been necessary to translate a large amount of material obtained from American sources, such as reports and information by the National Safety Council and the Portland Cement Association. The Cuban mill has participated regularly in the June no-

accident campaign of the association and for several years has qualified as an entrant in the association trophy contest.

On learning recently of the success of Cuba's only cement mill in winning the highest award conferred by the Portland Cement Association, President Garardo Machado of the republic wrote to warmly commend the good work of the workmen and management and to extend wishes for a long continuance of the good record.

As a result of earnest efforts to build up a good first-aid team the plant boasts one of the best on the island. In order to provide encouragement a bonus system for departments operating without accident was inaugurated. This has acted to stimulate the interest of the men and to demonstrate the sincerity of the management in its efforts to eliminate personal injury.

Results indicate progressive management, hard work on the part of those assuming responsibility for the accident prevention work, and most of all a delightful spirit of cooperation which has made the employees both "actively contented" and "contentedly active" in their work.

October Accidents in the Cement Mills

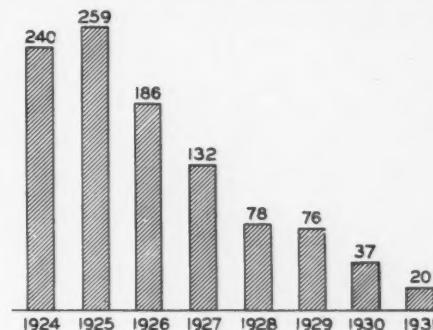
OCTOBER proved to be a relatively safe month in the mills and quarries represented in the membership of the Portland Cement Association. There occurred 19 lost-time accidents and one fatality, as compared with 33 lost-time accidents and one fatal mishap during the preceding month. During October, 1930, there were a total of 37 recordable accidents, of which four terminated fatally and 33 caused loss of time.

The fatal accident reported during the past month occurred when an assistant chemist fell through a manhole and was suffocated in a bin of cement below. The victim had climbed to the top of a silo and had removed the cover from a roof manhole in order to gage the cement in stock. He was not missed for a few hours. His body was discovered later, in the cement at a depth of 59 ft.

There were no witnesses and it is presumed that he became dizzy while looking

into the manhole, and being a small man, slipped through. As a means of preventing future accidents of this kind it has been recommended that a 10-in. hole be cut in the covers of such manholes and fitted with lids. The smaller opening will afford sufficient room for gaging so that the covers may be bolted down.

Three of the lost-time accidents of the month involved permanent disabilities. An employe engaged in wiping grease cups on a water pump allowed the waste held in his hand to become caught in a gear. The waste drew his hand between the gear and a shield, causing injuries to his hand which necessitated amputation of the first two fingers and probable loss of one joint of each of the remaining fingers. This accident could have been avoided by heeding the frequently made



October accidents

suggestion not to work on machinery of any kind while in motion.

While sanding the trunnion roll of a coal dryer, an employe's sleeve was caught between the tire and the roll, pulling his hand between them. Resulting injuries necessitated amputation of the first and fourth fingers. It may be necessary to amputate the remaining fingers.

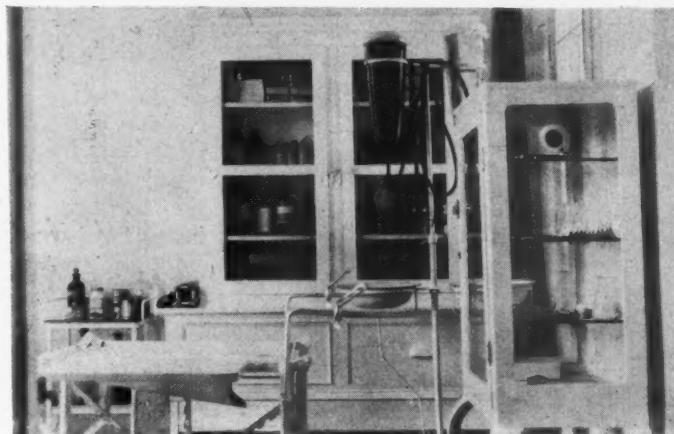
A pit man was engaged in removing scotch from under a steam shovel when the latter backed and jammed his finger against the rail. His injuries necessitated the amputation of the second finger at the first joint.

Chain Accidents

A number of accidents of more or less seriousness have resulted lately from chain



First aid team



First aid room

and cable failures in connection with power shovel operation. One of the leading shovel manufacturers, when informed of the situation by the Portland Cement Association, offered the following suggestions on the proper care and maintenance of chain and cable equipment:

"Careful examination should be made, watching for excessive wear and when the links show such wear, the chain should be given immediate attention. As it is customary to heavily lubricate a chain, it is impossible to note any fracture in a link and for this reason we suggest that the chain be removed from the machine once every three months, placed in a fire to remove the lubrication, then carefully checked for fractures and if found in good condition, anneal and replace on the machine.

"In the case of wire rope, it is much easier to detect failure, as invariably a rope starts to fail by wires breaking, then stranding. A cable should be watched closely, inspected thoroughly at least once a week and if evidence of failure is noted, it should be removed.

"There also should be a rule forbidding workmen on the ground being underneath a dipper where hoist chain or rope failure may result in serious injury or death to such person.

"On machines built by this company, hoisting chain and cables have an ample factor of safety which, however, will disappear as the chain or cable is used, therefore, protection against accidents depends entirely upon inspection and care."

Appointed to Executive Committee of National Crushed Stone Association

W. R. SANBORN, vice-president and general manager of the Lehigh Stone Co., Kankakee, Ill., has been appointed a member of the executive committee of the National Crushed Stone Association. Mr. Sanborn has been long and intimately connected with association affairs and has served as a member of the board of directors for many years, being at present regional vice-president of the northern region and chairman of the association's transportation committee. Mr. Sanborn was appointed to fill the vacancy recently created by the resignation of Howard Bair, vice-president of the France Stone Co., Toledo, Ohio.

To Build Lime Plant in Texas

BIG SPRINGS, TEXAS, was assured of another industry when a contract was entered into by a representative of a lime manufacturing company in Arkansas and Joe B. Neel for permission to mine 320 acres of land just south of there, which contains limestone testing more than 97% CaCO_3 . The lime kilns will be completed and the company is to begin operations within 10 days.—*Dallas (Tex.) News*.

Elect Sewell L. Avery, U. S. G., Chairman of Board of Montgomery Ward

AT A MEETING of directors of Montgomery Ward & Co., Sewell L. Avery, president of United States Gypsum Co., was elected chairman of the board to succeed Silas H. Strawn, who becomes chairman of the executive committee.

In discussing the election of Mr. Avery to this position the *Wall St. (N. Y.) Journal* says:

"Mr. Avery is well qualified both by character and experience to assume his



Photo by Carson Pirie Scott—Underwood
Sewell L. Avery

new position. In 1905, at the age of 31 he was elected president of U. S. Gypsum Co., which he has since built up steadily.

"Net profit rose with particular rapidity during the past decade. From little more than \$1,000,000 in 1919, it reached \$8,414,000 in 1925 and was little less in 1926. A price war in the gypsum industry brought net down to \$5,102,000 in 1929, but settlement of the controversy in that year enabled net to rise to \$5,408,000 in 1930. In the first half this year the company more than covered its regular dividend requirements of \$1.60 a share for the entire year.

"Mr. Avery's dividend policy has consisted of a low basic rate, supplemented by extras in cash and stock as earnings warranted. Expansion has consistently been financed in such a way as to avoid burdening the company with funded debt or impairing its liquid position.

"Mr. Avery is at present a director of Armour & Co., Chicago Great Western Railroad, *Chicago Daily News*, Container Corp., Continental Illinois Bank and Trust

Co., where he is a member of the executive committee, Northern Trust Co., U. S. Steel Corp. and State Bank and Trust Co. of Evanston.

"On these various boards, his opinions as a rule are given great weight by both directors and officers.

"His assumption of executive responsibility in Montgomery Ward and Co. may well form another major turning point in that company's affairs.

"Failure to come to agreement with Sears-Roebuck on terms for a merger, impelled directors to seek outside aid and Mr. Avery was selected.

"Following his election as chairman of the board of Montgomery Ward and Co., Mr. Avery made it plain that his new connection does not mean any lessening of his interest and activity of U. S. Gypsum Co., of which he is president."

The *Chicago (Ill.) Daily News* reports that it is understood that Mr. Avery will divide his time between the executive duties of the gypsum company and the mail order house, spending approximately half a day at each office.

It is stated the policy of the United States Gypsum Co. will not be effected by Mr. Avery's election to this position.

Alabama Quarry Buys Equipment for New Units

C. A. EAST, owner of the East Quarry, announced recently that he is preparing to erect a road building material plant at Rock Springs, Ala., in connection with his fluxing stone plant there and that it will be ready for operation around the first of the year.

The new mill will turn out crushed limestone for road and other building purposes. It will be equipped to give any sizes desired and to meet any demand that may arise.

The company intends to bid for all of the business in the southeastern territory and beyond.

Burned limestone for fertilizer purposes will be one of the main products of the new plant.

Mr. East said that the machinery would cost upwards of \$10,000 and that it had been purchased.

The Louisville and Nashville railroad has made surveys for additional tracks so that the new business will not interfere in any way with the old. In fact, it will be entirely separate.

"I find that there is a big demand for crushed limestone for roofing, road building and fertilizing purposes and I believe that my new plant will find plenty to do at the start," Mr. East said. "At any rate I am going to put in a modern crushing and burning plant. There will be four storage bins alongside the spur tracks to take care of rush orders."—*Gadsden (Ala.) Times*.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Concrete Plant Uses Bulk Cement and Agitator Type Trucks

Ready Mixed Concrete Co., Lancaster, Penn., Operates New Plant of Concrete and Steel Construction

THERE seems to be a tendency on the part of established companies in the ready mixed concrete field to branch out and have one or more plants in neighboring cities, even though the cities are not of comparatively large size. In that way each plant can have enough truck mixers to take care of the normal amount of business in its locality, and in case a big job is to be poured the trucks from the neighboring plants can be shifted to the large job to take care of the peak demands. Thus one of the great objections to entering into the ready mixed concrete business is overcome, that of the large investment in trucks necessary to take care of the peak loads.

A good example of this trend may be seen in the Ready Mixed Concrete Co. of Lancaster, Penn., which company is affiliated with the Ready Mixed Concrete Co., Reading, Penn., and the York Concrete Co., York, Penn. It was recently announced that they also expect to go ahead with the construction of an additional plant at Baltimore, Md. The Reading plants have a total of 13 trucks, with six trucks at the York plant and four at the new plant at Lancaster.

The new plant located at Walnut and Water streets, Lancaster, has several interesting features. Ground space so close to the center of town was not only valuable but scarce so that a compact plant was essential. The entire plant, including the storage space for sand, cement, office and turning space for the trucks, is on a plot of ground only 60 ft. by 60 ft. A location could have been had further away from the business district but the truck haul to the important jobs that are expected to come up in that city would have been greater. The small ground space used for this 600-yd. per 10-hr. day plant makes it outstanding in that respect, if for no other reason.

The plant is of reinforced concrete and steel construction with wooden floors and steel window sash was used throughout. The working places as well as the adjoining office

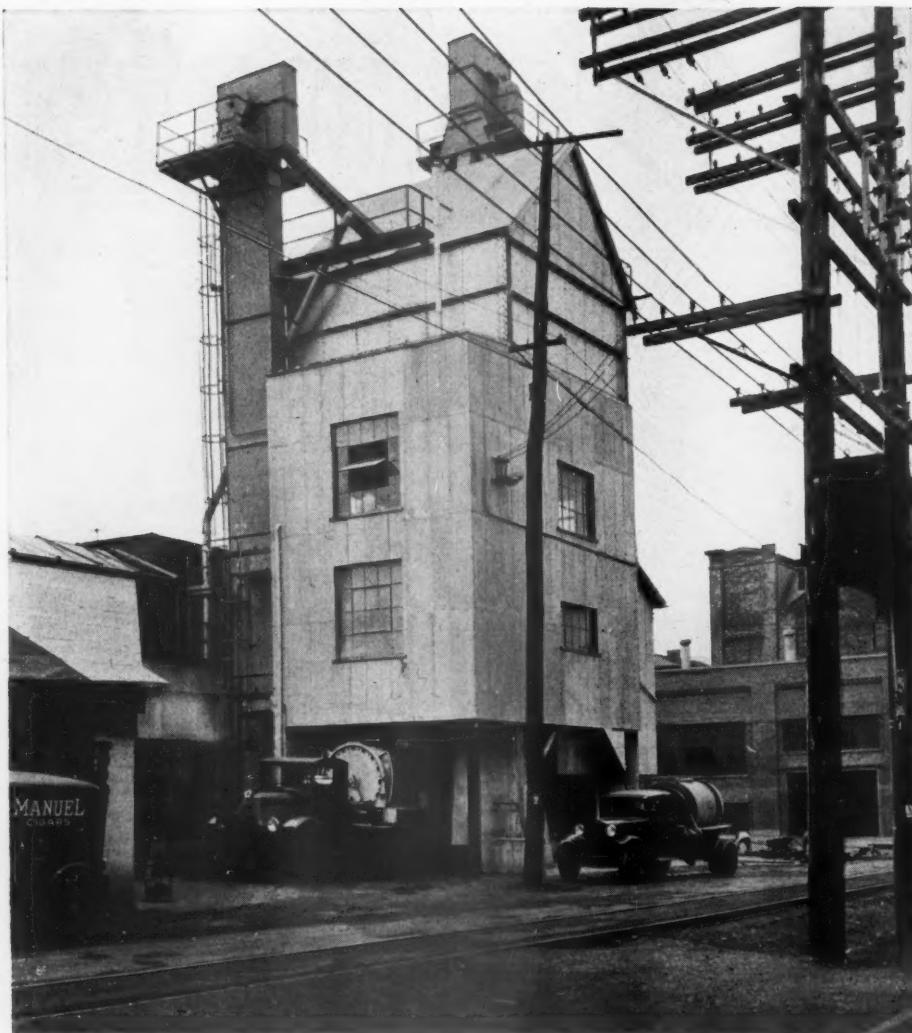
are protected from the cold by insulated wallboard.

The plant was designed by the engineers of the company in cooperation with engineers of the Chain-Belt Co., Butler Bin Co. and John H. Wickersham Co. of Lancaster, who erected the plant.

Cement is furnished in bulk in specially designed cars by the Hercules Cement Corp. over the tracks of the Pennsylvania railroad. These cars are emptied from a trestle to a steel bin below which holds about two cars of bulk cement. This bin has a hopper bottom and discharges to a small screw con-



General view of Lancaster plant



Opposite side of the plant, showing one of the large trucks being loaded

veyor which carries the cement to a cross conveyor. The cross conveyor in turn slightly elevates the material to the boot of a bucket elevator which carries it up to a bin having a capacity of 100 bbl. of cement, located above the weighing hopper.

The screw conveyors below the cement

storage bin are driven by a 3-hp. Crocker-Wheeler induction motor through a self contained reduction unit which is a part of the motor itself. The motor operates at a speed of 1150 r.p.m., which is reduced to 115 r.p.m. The first screw conveyor is driven through a short chain drive from the reducer and the

cross conveyor is driven by bevel gears and a short chain drive.

Air for agitating the cement in the storage bins is provided by a small Kellogg Manufacturing Co. compressor which is mounted above a small horizontal receiver of the same make. The compressor is driven by a 2-hp. General Electric induction motor through a four-strand Gilmer "V" belt drive.

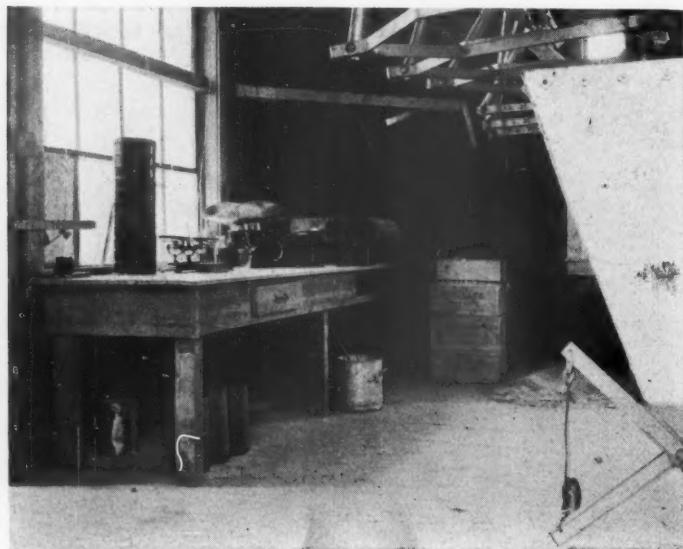
Three-Compartment Bin

The concrete aggregates are contained in a three-compartment bin arranged with one compartment for sand, one for a medium sized aggregate and one for coarser aggregate. These bins have a total capacity of 215 cu. yd. Crushed stone is used almost exclusively as the coarse aggregate. The sand is delivered to the plant in hopper-bottom gondolas which are discharged to a storage space alongside the cement track hopper, where there is room for about five cars of sand. The coarse aggregate is delivered to the plant in trucks and discharged to a hopper serving a bucket elevator. The sand storage pile is also connected to this elevator by a spout so that sand may be drawn by gravity from the pile to the elevator as needed.

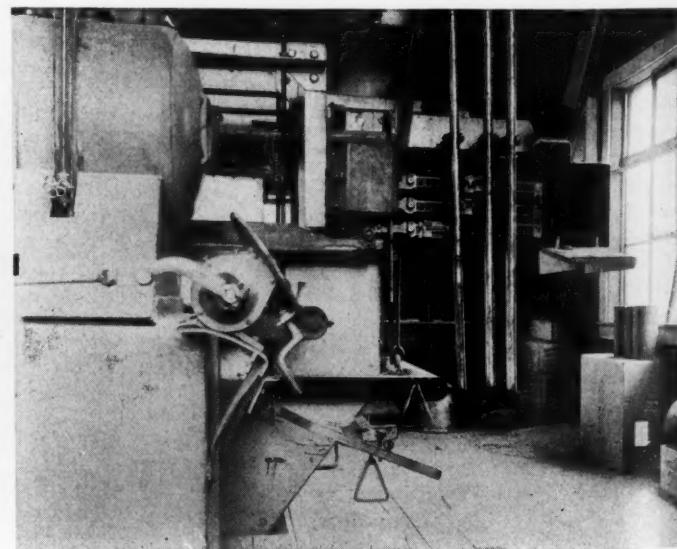
Only one of the aggregates is elevated at one time. The discharge point of the elevator is arranged with three chutes serving the three bin compartments and these chutes are arranged with gates so that each material can be diverted into its proper bin. This can be done from the trucking floor by means of ropes and levers without going to the top of the elevator.

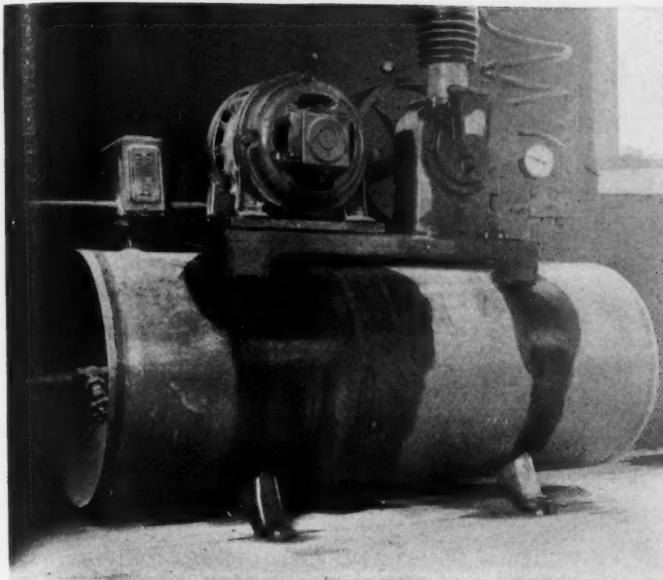
All aggregates for the Lancaster plant are purchased from local dealers, while the company at Reading gets its aggregates through an affiliated material handling company.

The bins, weighing batchers and water measuring device were all supplied by the Butler Bin Co. The Chain Belt Co. furnished the 2-yd. Rex mixer, and the elevators and conveyors. General Electric start-

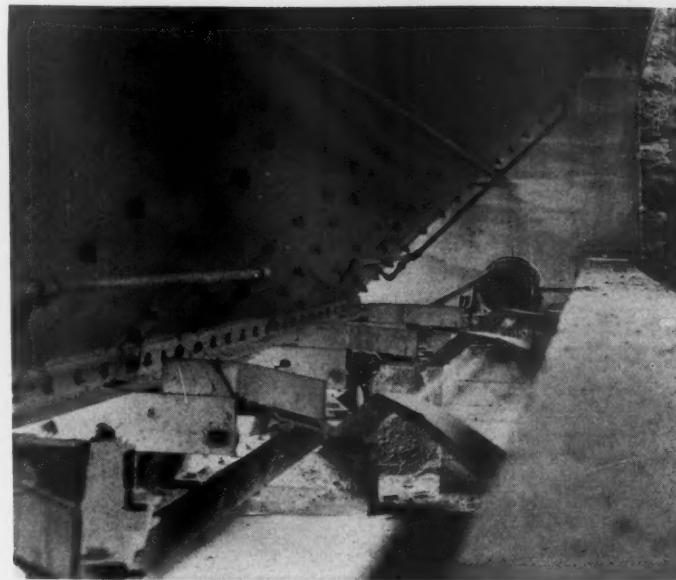


Two views in weighing room, showing testing laboratory equipment at left and scale beams and levers at right

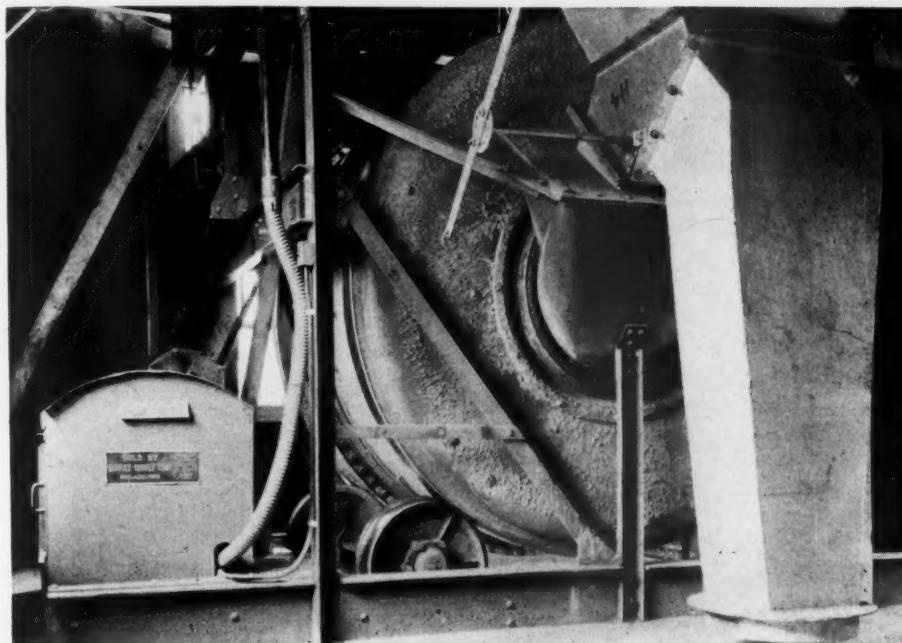




Air compressor unit for aerating cement in bins



Cement storage bin with screw conveyor and drive below



The 2-yd. concrete mixer with its drive

ers are used for the various motors along with Westinghouse safety switches.

A complete heating system has been installed for heating both water and aggregates.

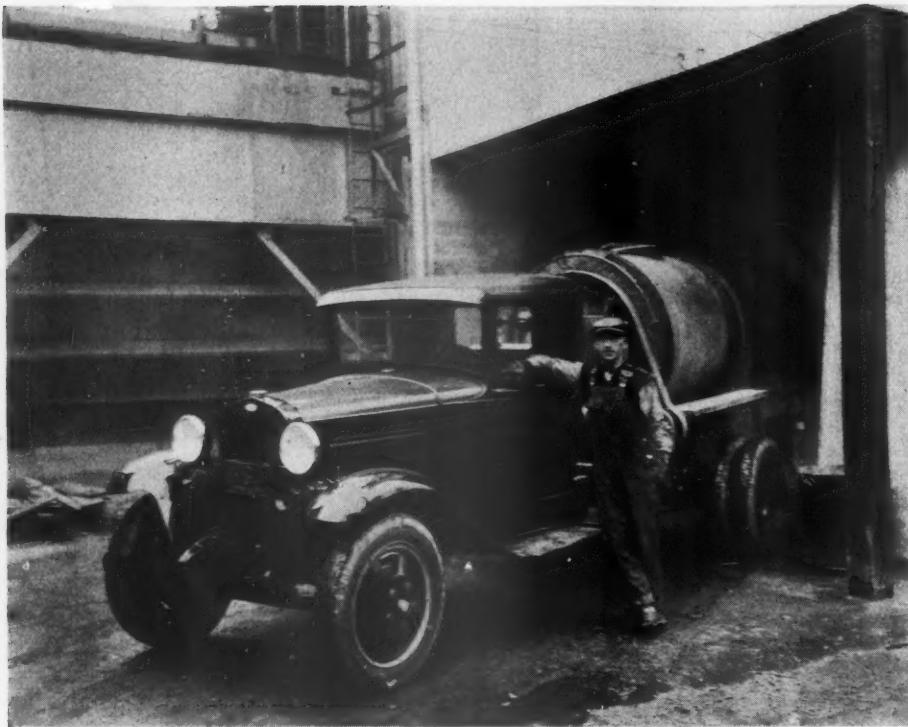
Lancaster, Penn., has a population of 60,000 and is the county seat of Lancaster county, which has a total population of about 200,000 people. It is said to be the richest agricultural county in the United States. Its people are very conservative and of the old Pennsylvania Dutch stock, but quick to adopt new labor saving devices on their farms. The advantages and economies of ready mixed concrete readily appealed to citizens of the community.

The 13 trucks at the Reading plant and the six at the York plant have bodies of the Clinton agitator type. At the Lancaster plant four Mack trucks with 6-yd. Blaw-Knox bodies are used in addition to a 2-yd. Blaw-Knox body mounted on a Ford truck. This smaller unit, which is known as the "baby blimp," has proven quite satisfactory on small jobs, as it can be moved into almost any position and has a low upkeep cost.



Water measuring apparatus at left with safety switch and starter for mixer at right





The "baby blimp" which has a 2-yd. agitator body

The 2-yd. drum on this small unit is revolved by a Le Roi gasoline engine, while the larger 6-yd. drums are rotated by Hercules gasoline engines.

All concrete is proportioned under the direction of the Pittsburgh Testing Laboratory, which maintains an inspector at the Lancaster plant who makes daily tests on all the materials used and certifies each load of concrete.

The company is owned and controlled by Arthur M. Dives, who is also treasurer of the companies at Reading and York. A. L. Sherts is manager at Lancaster.

Plans Crushing Plant in California

RALPH SIMONS of the Standard Brick Co., who recently made a lease with the city of Redlands, Calif., for the old rock crusher site near Mentone, has asked for a 20-year instead of the five-year lease for which he originally asked.

He announced that the company has decided to put up a plant which will cost almost \$100,000. The city is ready to grant a 10-year lease, officials say.—*Los Angeles (Calif.) Times*.



One of the 6-yd. agitator type trucks

Reports on Ford Limestone Purchase

THE Ford Motor Co. has completed the purchase of 7000 acres of limestone near Cedarville, Mich., in the eastern part of the upper peninsula, as was reported in Rock PRODUCTS November 21. Lands near DeTour are now being tested with diamond drills and will be acquired if the limestone proves of a desirable grade.

In addition to the above announcement made recently, the Ford company has started work clearing 500 acres of land at Gladstone, where a considerable acreage near Lake Michigan was purchased earlier in the year.

It is understood that the limestone acquired will be used in connection with the Gladstone development. When the Gladstone purchase was made it was believed that a reduction plant to treat iron ores of low grade would be constructed, and later there was a rumor that the usual type of blast furnace would be erected. More recently there has been talk that Ford wanted dolomite, from which it was intended to remove the magnesium to be used in the manufacture of a light metal similar to "dowmetal," which is finding a market in the automobile and airplane industries. This metal is lighter than aluminum and believed to be just as durable.

The Ford company already owns a large deposit of limestone near Alpena, but there has been no development there. The lake haul from either Cedarville, DeTour or Alpena to Gladstone would be a short one.

Henry Ford keeps his plans pretty much to himself and many guesses made regarding what is to be done on the Gladstone site will have to be discarded later on. There is no doubt, however, that he has plans to link up his iron ore holdings with a fluxing material for the manufacture of iron ore steel at this Lake Michigan port.—*Ishpeming (Mich.) Iron Ore*.

Revive Cyanite Industry in North Carolina

THE SHIPMENT of several carloads of cyanite, destined for St. Louis, Mo., and obtained from various properties near Black Mountain, N. C., during the past several weeks, has served to revive interest in the mineral possibilities of the Black Mountain section.

The cyanite, used mainly at present to give added strength to clay products, is said to be for a large manufacturer of spark plugs.

James H. McCoy of Asheville, who is well known in the mining business in western North Carolina, has been active in the mining and shipping of cyanite from this section in recent weeks.

Quantities of the rock in this section, particularly on properties of the Montreat Association, have been pointed out in the past by State Geologist Bryson, and it is possible that further purchases will be made.—*Asheville (N. C.) Citizen*.

Current Prices of Ready-Mix Concrete

AMARILLO, TEX.—Prices per cu. yd.*

	Lime Mortar	Mix	Terrazzo
Mix			
1-4	6.50	1-3 -0	9.75
1-4½	6.25	1-3½ -0	9.25
1-5	6.00	1-4 -0	8.75
		1-4½ -0	8.50
		1-5 -0	8.25
Topping			
Mix			
1-1 -0	13.75	Base—Strength	9.75
1-1½ -0	12.75	4000 lb. per sq. in.	9.75
1-2 -0	11.75	3500 lb. per sq. in.	9.25
1-2½ -0	11.25	3000 lb. per sq. in.	9.00
1-3 -0	10.75	2500 lb. per sq. in.	8.75
1-3½ -0	10.25	2000 lb. per sq. in.	8.50
		1500 lb. per sq. in.	8.25
Base			
Mix			
1-2 -3½	9.25	1-3 -5	8.00
1-2½ -4	9.00	1-4 -6	7.25
1-3½ -4½	8.00		

*For orders of 50 cu. yd. or more, prices are 75c less per cu. yd. than quoted. Free delivery within city limits for 2 cu. yd. or more per load; \$1.00 per load extra for less than 2 cu. yd. loads, except to finish a job. Additional charge of 10c per mile per cu. yd. for deliveries outside of city limits.

BELLINGHAM, WASH.—Prices per cu. yd.†

	Retail, f.o.b. In				
Mix	bunkers carloads	Mix	bunkers carloads		
1-3-4	6.85	6.10	1-2-3	7.85	6.91
1-3-5	6.51	5.75	1-2-4	7.27	6.50

†Additional charges for delivery to various zones. First zone, added charge of 75c per cu. yd.; second zone, added charge of \$1.05; third zone, added charge of \$1.40; fourth zone, added charge of \$1.75.

BOSTON AND CAMBRIDGE, MASS.—Base price per cu. yd.‡

Mix	Mix	Mix	Mix
1-2-4 (3 to 30 cu. yd.)	10.00	1-2-3 (30 cu. yd. and over)	8.20
1-2-4 (30 cu. yd. and over)	7.75	1-1½-3 (3 to 30 cu. yd.)	10.55
1-3-6 (3 to 30 cu. yd.)	9.50	1-1½-3 (30 cu. yd. and over)	8.30
1-3-6 (30 cu. yd. and over)	7.25	1-1-2 (3 to 30 cu. yd.)	11.30
1-2½-5 (3 to 30 cu. yd.)	9.75	1-1-2 (30 cu. yd. and over)	9.05
1-2½-5 (30 cu. yd. and over)	7.50	1-2 (3 to 30 cu. yd.)	13.00
1-2-3 (3 to 30 cu. yd.)	10.45	1-2 (30 cu. yd. and over)	10.75

‡Discount of 50c per cu. yd. allowed on deliveries made between the 1st and 15th of the month if bill is paid on or before the 25th and on deliveries made between 15th and 30th if paid on or before the 10th of following month.

CHAMPAIGN, ILL.†—Prices per ton (weight, 4000 lb. per cu. yd.)

Mix	Mix	Mix	
1-2-3	5.25	1-2-4	4.75
1-3-5	4.50		

†5% trade discount to contractors. Prices to both contractor and consumer subject to cash discount of 5% for payment by 10th of month following del. For quick strength concrete, 1-2-3 mix, extra charge of \$1.50 per ton; 1-2-4 mix, \$1 per ton extra. Added charge of 25c per ton for the use of chloride, lime or Celite in any wet mix. For heating concrete, 12½c extra per ton. For topping, any mix, \$1.35 for each sack of cement used.

COLUMBUS, OHIO—Delivered prices per cu. yd.

Mix	1	2	3	4	5	6	7	8	9	10	Zones\$
1-1½-3	7.05	7.25	7.45	7.65	7.85	8.05	8.25	8.45	8.65	8.85	
1-2 -3	6.85	7.05	7.25	7.45	7.65	7.85	8.05	8.25	8.45	8.65	
1-2 -3½	6.65	6.85	7.05	7.25	7.45	7.65	7.85	8.05	8.25	8.45	
1-2 -4	6.45	6.65	6.85	7.05	7.25	7.45	7.65	7.85	8.05	8.25	
1-2½ -4	6.35	6.55	6.75	6.95	7.15	7.35	7.55	7.75	7.95	8.15	
1-3 -4	6.25	6.45	6.65	6.85	7.05	7.25	7.45	7.65	7.85	8.05	
1-2½ -5	6.15	6.35	6.55	6.75	6.95	7.15	7.35	7.55	7.75	7.95	
1-3 -5	6.05	6.25	6.45	6.65	6.85	7.05	7.25	7.45	7.65	7.85	
1-3 -6	5.95	6.15	6.35	6.55	6.75	6.95	7.15	7.35	7.55	7.75	
1-4 -8	5.85	6.05	6.25	6.45	6.65	6.85	7.05	7.25	7.45	7.65	
1-2	9.55	9.75	9.95	10.15	10.35	10.55	10.75	10.95	11.15	11.35	
1-3	7.95	8.15	8.35	8.55	8.75	8.95	9.15	9.35	9.55	9.75	

¶All zones radiating from center of city. Zone 1 is one mile in radius, zone 2 is two miles in radius, zone 3 is three miles in radius, etc. Discount of 25c per cu. yd. allowed for payment 10th of month following delivery date. For orders over 50 cu. yd. a deduction of 25c per cu. yd. is allowed. Orders of less than 2 cu. yd. carry same haul charge as 2 cu. yd. load. Orders for 2 cu. yd. or over delivered in full loads at 2 yd. or more.

DALLAS, TEX.†

Strength	½ in. to	3 in. to	6 in. to	7 in.	Strength	½ in. to	3 in. to	6 in. to	7 in.	Slump
1500	5.50	5.70	6.10	2500	6.05	6.25	6.65			
2000	5.80	6.20	6.30	3000	6.40	6.80	7.00			
1-2½-5	6.70	1-2-4	7.00	1-1½-3	7.70					

†Prices subject to 2% 15 days and are based on quantities of 50 to 999 cu. yd. and on delivery in 2½-cu. yd. loads within Zone 1, which extends about 1½ miles from either of two plants. Zone charges are approximately 10c per cu. yd. per mile beyond the Zone 1 limit. On quantities under 50 cu. yd. add 20c and on quantities over 1000 cu. yd. deduct 30c.

CLEVELAND, OHIO (a)—Prices per cu. yd. to contractors for orders of 2 cu. yd. or more.

Aggregate: Limestone		Public Square basing point		
Mix		1st mile	2nd mile	3d mile (Maximum)
1-1 -2		7.50	7.75	8.00
1-2 -3		6.30	6.55	6.80
1-2 -4		6.00	6.25	6.50
1-2½ -3½		6.00	6.25	6.50
1-2½ -4		5.80	6.05	6.30
1-3 -4		5.70	5.95	6.20
1-2½ -5		5.60	5.85	6.10
1-3 -5		5.50	5.75	6.00
1-3 -6		5.40	5.65	5.90
1-4 -8		5.25	5.50	5.75
1-2	Finish	7.50	7.75	8.00
1-2½	Finish	7.00	7.25	7.50
1-3	Finish	6.50	6.75	7.00

Basing point: Windfall Road and Broadway, Bedford, Ohio

Aggregate: Bedford gravel		Miles				
Mix		1st	2nd	3rd	4th	5th
1-1 -2		6.50	6.75	7.00	7.25	7.50
1-2 -3		5.30	5.55	5.80	6.05	6.30
1-2 -4		5.00	5.25	5.50	5.75	6.00
1-2½ -3½		5.00	5.25	5.50	5.75	6.00
1-2½ -4		4.80	5.05	5.30	5.55	5.80
1-3 -4		4.70	4.95	5.20	5.45	5.70
1-2½ -5		4.60	4.85	5.10	5.35	5.60
1-3 -5		4.50	4.75	5.00	5.25	5.50
1-3 -6		4.40	4.65	4.90	5.15	5.40
1-4 -8		4.25	4.50	4.75	5.00	5.25
1-2	Finish	7.00	7.25	7.50	7.75	8.00
1-2½	Finish	6.50	6.75	7.00	7.25	7.50
1-3	Finish	6.00	6.25	6.50	6.75	7.00

*Maximum.

(a) Industrials or consumers 50c more than contractors. Extra charge for concrete delivered nights, Sundays or holidays, \$1.00 per cu. yd. over daytime schedule. For high早-strength or waterproofing cements additional charge of \$2.00 per cu. yd. For waterproof concrete using Anti-Hydro with manufacturer's guarantee, additional charge of \$2.00 per cu. yd. For orders less than 2 cu. yd. add \$1.00 per cu. yd. to above prices. Prices quoted are based upon normal discharge of load within 20 minutes after arrival of truck. A demurrage charge of \$1.00 for each 15 minutes thereafter.

DES MOINES, IOWA—Prices per cu. yd. (b)

(Made with ¾-in. gravel for structural work)		Zone			
Mix	Slump	Plant price	A	B	C
1-2½ -5	2 in.	6.00	6.50	6.75	7.00
1-2½ -5	6 in.	6.25	6.75	7.00	7.25
1-2 -4	2 in.	6.50	7.00	7.25	7.50
1-2 -4	6 in.	6.75	7.25	7.50	7.75
1-2 -3½	2 in.	7.00	7.50	7.75	8.00
1-2 -3½	6 in.	7.25	7.75	8.00	8.25
1-2½ -3	2 in.	7.50	8.00	8.25	8.50
1-2½ -3	6 in.	7.75	8.25	8.50	8.75

(Made with pea gravel for cellar and sidewalks)

		Zone			
Mix	Slump	Plant price	A	B	C
1-2½ -5	2 in.	5.75	6.25	6.50	6.75
1-2½ -5	6 in.	6.00	6.50	6.75	7.00
1-2 -4	2 in.	6.25	6.75	7.00	7.25
1-2 -4	6 in.	6.50	7.00	7.25	7.50
1-2 -3½	2 in.	6.75	7.25	7.50	7.75
1-2 -3½	6 in.	7.00	7.50	7.75	8.00
1-2½ -3	2 in.	7.25	7.75	8.00	8.25
1-2½ -3	6 in.	7.50	8.00</td		

LOS ANGELES, CALIF.||—Prices per cu. yd.

Mix	1-5 yd.	5-25 yd.	25 or more	Mix	1-5 yd.	5-25 yd.	25 or more
3-50-50	8.25	7.25	6.25	1-2-3-4-3½	10.00	9.00	8.00
4-50-50	8.85	7.85	6.85	1-2-4	9.85	8.85	7.85
1-3-6	8.95	7.95	6.95	1-2-3-4-3½	10.10	9.10	8.10
1-3-5	8.95	7.95	6.95	1-2-3-4-3½	10.05	9.05	8.05
1-3½-5	9.50	8.50	7.50	1-2-3	10.60	9.60	8.60
1-3-4	9.75	8.75	7.75	1-2-3-4	10.20	9.20	8.20

||Above prices for deliveries in Zone 1 (1-5 miles). Added charge of 75c per cu. yd. for deliveries in Zone 2 (5 to 10 miles). Added charge of \$1.50 for Zone 3 (10 to 15 miles). Discount of 50c per cu. yd. if payment is made within 10 days from delivery.

MEMPHIS, TENN.—Prices per cu. yd. delivered in city.†

Strength	Portland	"Incor"	Strength	Portland	"Incor"
1800 lb.	6.50	7.30	3000 lb.	8.00	9.25
2000 lb.	7.00	8.00	3500 lb.	8.60	10.00
2500 lb.	7.50	8.50	4000 lb.	9.80	11.75

†Above prices based on gravel for aggregate. If stone is wanted for aggregate, additional charge of \$1.00 per cu. yd. is made to above prices. 5% cash discount for payment 10th of month following date of invoice.

MILWAUKEE, WIS.—Prices per cu. yd. (e)

28-day breaking strength:		Per sq. in.	2 to 4 in.	4 to 6 in.	6 to 8 in.	Slump
Garage footings and walls	2000 lb.	4.50	4.75	5.00		
Footings, floors, walls	3000 lb.	5.50	5.75	6.00		
City paving	3300 lb.	4.75				
Sidewalks, curbs	4000 lb.	5.75	6.00	6.25		
24-hour high early strength	5000 lb.	7.00	7.50	8.00		

Sold on old mixture method, 2- to 4-in. slump; 4- to 6-in. slump; 6- to 8-in. slump.

	Mix		Mix		Mix
Walls—Garage footing	1-3-5		4.50		
City paving	1-2-4		4.75		
Garage floors, walls	1-3-3		5.50		
Sidewalk	1-2-3		5.75		
Special strength (machine bases)	1-1½-2½		7.00		
Facing	1-3		8.00		
Facing	1-2		10.00		

(e) Discount of 25c per cu. yd. if paid by 10th of following month.

MONTGOMERY, ALA.—Prices per cu. yd. delivered in city limits. (g)

Mix	Mix	
1-2-4	6.25	1-3-6
1-2½-5	5.85	1-2 mortar topping

(g) Discount of 25c per cu. yd. for payment in 30 days. Special quotations for quantity orders.

MORGANTOWN, W. VA.—Prices for jobs of 1 to 10 cu. yd., delivered (f)

Mix	Mix	
1-2-3	9.50	1-2½-4
1-2-4	9.00	1-2½-5

(f) Prices subject to cash discount of 25c per cu. yd. for payment 15 days from date of invoice.

NEW ORLEANS, LA. (h)—Plant prices per cu. yd. for 30 yd. or less.

Mix	Cement	Portland	"Incor"	Mix	Cement	Portland	"Incor"
1-4-8	5.15	6.10		1-2-2	7.70	10.25	
1-3-6	5.75	7.00		2-3-6	8.05	10.55	
1-3-5	5.95	7.35		2-3-3	8.85	12.00	
1-2½-5	6.25	7.80		1-½ topping	10.95	15.80	
1-2½-4	6.40	8.15		1-2 topping	9.30	13.25	
1-2-4	6.75	8.60		1-3 topping	7.85	10.85	
1-2-3	7.20	9.40					

Plant prices per cu. yd., 30 cu. yd. or over:

Mix	Cement	Portland	"Incor"	Mix	Cement	Portland	"Incor"
1-4-8	4.65	5.45		1-2-2	6.95	9.15	
1-3-6	5.15	6.25		2-3-6	7.25	9.45	
1-3-5	5.35	6.55		2-3-3	8.00	10.70	
1-2½-5	5.65	7.00		1-½ topping	9.85	14.10	
1-2½-4	5.80	7.25		1-2 topping	8.40	11.80	
1-2-4	6.05	7.70		1-3 topping	7.05	9.60	
1-2-3	6.50	8.40					

(h) All prices subject to 5% 15 days, 30 days net. Haulage based on various zones.

NEWARK AND HARRISON, N. J.§

1-2-4	7.50	1-3-6	6.75
1-3-5	7.00	1-2½-5	6.85

§Discount of 2% if paid by 10th of month following delivery.

NEW YORK CITY, N. Y.‡—Prices per cu. yd.

Mix	Manhattan and Bronx	Queens
1-1½-3	10.00	1-1½-3
1-2-4	9.25	1-2-4
1-2½-5	8.75	1-2½-5
1-3-6	8.25	1-3-6

Westchester County (within radius of 7 miles)

1-1½-3	9.25	1-2½-5	8.00
1-2-4	8.50	1-3-6	7.50

Brooklyn

Mix	Under	Over	Mix	Under	Over
1-1½-3	50 cu. yd.	50 cu. yd.	1-2-2	50 cu. yd.	50 cu. yd.
1-2-4	9.50	8.50	1-2½-5	9.00	7.75
1-2-4	9.25	8.00	1-3-6	8.75	7.50

‡Special designed mixes on the strength basis priced according to the strength desired.

Rock Products

OMAHA, NEB.*—Prices per cu. yd. for quantities from 1 to 300 yd., delivered anywhere within the city.

28-day strength		28-day strength	
No. 1. 3500 lb. sq. in.	7.35	No. 3. 2500 lb. sq. in.	6.95
No. 2. 3000 lb. sq. in.	7.15	No. 4. 2000 lb. sq. in.	6.75

Transit-Mix Concrete

28-day strength		28-day strength	
No. 1. 3600 lb. sq. in.	7.50	No. 3. 2600 lb. sq. in.	7.10
No. 2. 3100 lb. sq. in.	7.30	No. 4. 2100 lb. sq. in.	6.90

*Sand-gravel mix used as aggregate. No. 1, 6 sacks cement per cu. yd. concrete; No. 2, 5½ sacks cement; No. 3, 5 sacks cement; No. 4, 4½ sacks cement. For high-early-strength concrete using "Quikard" or other super-cement, add \$2.50 per cu. yd.

PITTSBURGH, PENN.—Range of prices, according to zone, for ready-mixed concrete. Prices per cu. yd. delivered, up to 50 cu. yd. (j)

Mix	Strength	Mix	Strength		
1-1½-2½	4000 lb.	8.10	1-2½-4½	2500 lb.	7.25
1-2-3	3500 lb. +	7.75	1-2½-5	2500 lb.	7.10
Class A	3500 lb.	7.60	1-3-5	2000 lb.	7.00
1-2½-3½	3000 lb. +	7.50	1-3-6	1500 lb.	6.90
1-2-4	3000 lb.	7.40			

Prices per cu. yd. delivered, over 50 cu. yd. (j)

Strength	Mix	Strength	Mix		
1-1½-2½	4000 lb.	7.10	1-2½-4½	2500 lb.	6.25
1-2-3	3500 lb. +	6.75	1-2½-5	2500 lb.	6.10
Class A	3500 lb.	6.60	1-3-5	2000 lb.	6.00
1-2½-3½	3000 lb. +	6.50	1-3-6	1500 lb.	5.90
1-2-4	3000 lb.	6.40			

(j) Class A concrete is a special concrete prepared for the city of Pittsburgh. Plus indicates the strength shown is the minimum strength. Dealer's commission of 50c per cu. yd. allowed in all zones with exception of Yellow Zone. No commission allowed over 200 cu. yd. Prices subject to cash discount of 25c per cu. yd. for payment 15 days from date of invoice.

PUEBLO, COLO.—Prices per cu. yd.||

Strength	Zone 1	Zone 2	Zone 3	Strength	Zone 1	Zone 2	Zone 3
3000 lb.	8.00	8.40	8.80	2100 lb.	7.10	7.50	7.90
2700 lb.	7.75	8.15	8.55	1500 lb.	6.50	6.90	7.30
2400 lb.	7.50	7.90	8.30	1200 lb.	6.50	6.90	7.30

||On larger quantities to contractors, deduct 50c per cu. yd.

ROCHESTER, N. Y.—Prices per cu. yd.

Plant	price	Zone 1	2	3	4	5	6	7
1-2-3	7.00	7.75	7.90	8.05	8.20	8.35	8.50	8.65
1-2½-3½	6.55	7.30	7.45	7.60	7.75	7.90	8.05	

Against Extraordinary Inducements to Promote New Plants

THE PRACTICE of bonus-giving to attract new industries to communities is reviewed in a report just issued by the department of manufacture of the Chamber of Commerce of the United States, "Special Inducements to Industries."

The report presents in factual form the results of a survey of 261 communities. It shows opinion about evenly divided between communities that favor bonusing and those who oppose it. One hundred thirty-one communities, representing a population of 20,540,000, expressed themselves as opposed to all forms of inducement-giving. The remaining 130 communities, having a population of 7,020,000, approved industrial bonusing of various types, but were not unanimous in regard to the forms of such grants or the conditions under which they might justifiably be given.

Smaller and newer communities, the survey reveals, tended to favor inducement-giving to a wider extent than did larger communities, although there appeared to be no geographical concentration on either side of the question. The larger industrial centers, having attained their prominence in most cases because of inherent natural advantages, have not resorted to artificial measures to attract additional factories.

"To place themselves in a more favored position," says the report, "many communities adopt definite programs and policies for acquiring more industries. In addition to directing attention to their natural advantages as industrial centers, some communities are ready, if necessary, to make concessions of various kinds to prospective manufacturers. Cash bonuses are offered, free sites are made available, exemption from taxes is granted for longer or shorter periods, and numerous other inducements are paraded before the prospect to influence his decision."

Communities which advocate the granting of inducements express the belief that those localities which possess some distinct advantages as industrial sites, but which lack certain significant elements, can justifiably make concessions to assure the establishment of new plants. In support of this contention they point to specific instances of successful businesses being established through the application of various inducement plans.

On the other hand, those who oppose inducement-giving substantiate their point of view by enumerating failures among bonused industries. Inducements are temporary expedients, they say, and cannot overcome permanently the inherent economic disadvantages of a community not fundamentally suited to the sound development of industries.

On this point the report says:

"Communities endowed with physical, geographical or climatic advantages which serve

to attract industry and commerce to them, need rely upon few bonusing or inducement devices. Accessibility of markets, availability of raw materials, abundance of labor supply, and the presence of other special factors essential for development of specific industries are sufficiently important in themselves to attract industries. Where these elements are present in proper proportion, it is usually necessary for communities to offer other inducements. The managers of progressive, growing concerns are continually alert to the problem of locating their plants at points where the best balance between all elements of production, distribution and cost may be attained. When they are aware of such a location they require neither a special invitation nor any bonus from the community to establish a plant at that point. Most of our larger and older industrial centers owe their existence to this fact."

Editor Becomes President

ROCK PRODUCTS readers will probably be interested to know that its editor, Nathan C. Rockwood, has been elected president of the Tradepress Publishing Corp., publisher of *ROCK PRODUCTS*, *Concrete Products* and *Barrel And Box And Packages*, succeeding the late W. D. Callender.

However, this involves no change in Mr. Rockwood's relations with *ROCK PRODUCTS*. He will continue to be its editor, in addition to his other duties and responsibilities.

Mr. Rockwood is entering his fifteenth year as editor of this journal. Prior to that he was an associate editor of *Engineering News* and its successor, *Engineering News-Record*, for eight years. He has been president of the Trade Journal Co., 250 Fifth Ave., New York City, since last April, when this company was organized to publish *Trunks and Leather Goods*, with which was consolidated at that time *Luggage and Handbag Modes*.

Mr. Rockwood is a graduate in civil engineering of the Worcester Polytechnic Institute, class of 1907. Prior to his editorial and publishing experience he spent three years in engineering work, one year of which was as an officer in the United States Coast and Geodetic Survey, and another as structural engineer of the Gilmore and Pittsburg Railroad in Montana and Idaho.

Marquette Cement Shipments Up in October

CEMENT SHIPMENTS of the Marquette Cement Manufacturing Co., Chicago, for October were 25% greater than for the same month of 1930, it was announced recently by Theodore G. Dickinson, president. The greatest amount ever handled by the company in one day was a peak reached on October 3, when it broke its own record by shipping 55,000 bbl.—Chicago (Ill.) Tribune.

British Stone Producers Solve Difficult Competitive Situation

AN IMPORTANT CONTRACT has just been obtained by Thames Grit and Aggregates, Ltd., of England, from the Middlesex county council. The company represents an amalgamation of a considerable number of old-established London undertakings engaged in the production and sale of ballast for roadmaking and concrete construction purposes.

This contract concerns the work of excavation of the land at Mogden, a London suburb, on which the council is about to erect a sewerage works. It happens that the ground, some 21 acres, to be excavated contains a supply—estimated at some 650,000 cu. yd.—of good ballast.

Originally the Middlesex county council proposed to pay a firm of contractors to execute the work of excavating and preparing the ballast and itself to enter the ballast market in competition with existing merchants. In such circumstances any price which the council could have obtained would have meant a profit for it, so that the possibility was involved of serious price-cutting in the ballast trade.

Eventually, however, the council adopted an alternative proposal, whereby on payment of a lower sum for the work of excavation it allowed the contractor to retain the ballast as his own property. It is this contract which has been secured by the aforementioned ballast combine. Thus the threat of a serious disorganization of prices has been removed and the company will be able to work a very large new deposit on terms which it is hoped will contribute materially to the well-being of the undertaking.

Cement Association Considers New Award

AS A RESULT of the completion of five years without a lost-time accident by two of the member plants of the Portland Cement Association, a number of suggestions have been received proposing appropriate recognition for mill organizations which have been able to establish this new record—considered utterly impossible until a year or two ago.

The two successful plants are the Iola, Kan., mill of the Lehigh Portland Cement Co., which suffered its last lost-time accident on September 9, 1926, and the Ironton, Ohio, mill of the Alpha Portland Cement Co., where the last similar mishap occurred on December 8, 1926.

Within a few months several additional plants will have completed accident-free records of five years; that is, if the law of averages continues to operate as it has up to this time.

Belt Conveyor Theory and Practice

Part I—Capacity, Speed and Size of Lumps

By G. F. Dodge, M.E.

NOW, WHEN INDUSTRY everywhere is seeking ways and means of reducing installation and operating costs, would seem to be a good time to investigate belt conveyor practice and to modernize such formulae as recent experience indicates should be changed and to put before engineers in general a more thorough explanation of those elements governing good design.

For example, no published data that the author has seen enables the occasional designing engineer to determine under all conditions just what the maximum belt stress will be or how the type and location of the drive affects this stress. No published formula enables investigation of "speeded" (partially loaded) conveyors. Capacity formulae give too low results for all but the narrowest conveyors in common use.

One widely published formula apparently has no factor covering the power necessary to turn the pulleys of the troughing and return idlers. The coefficients used in this formula give reasonably good results when applied to the handling of material weighing 100 lb. per cu. ft., but it uses the same coefficients for all weights of material, and when applied to lighter materials weighing 75 lb. or 50 lb. the results are increasingly inadequate. Other deficiencies and errors in present available literature might be mentioned.

In this and succeeding articles the author will discuss the theoretical and practical elements entering into the design of troughed belt conveyors for handling such materials as stone, sand, cement, ore, coal, coke, etc.

The earlier installations of belt conveyors were generally of such short length that a belt of sufficient stiffness to support the load between the troughing idlers and maintain an approximately uniform troughed section was strong enough to transmit the necessary power. As they increased in length the belts were made thicker to get the required strength until finally they became too stiff to bend into contact with all the pulleys of the troughing idlers when unloaded and then could not be made to run straight.

Such practical limits of a sufficient and yet not too great stiffness of the belt must be observed and the installation designed within these limits. For the more commonly used weights of duck (28 oz. and 32 oz.), Table I indicates the number of plies that may safely be used and also gives the weights per foot of belt and the working strength of each.

Each ply of duck with its binding "fric-

tion" weighs about 0.28 lb. per sq. ft. and each 1/16-in. of cover weighs about 0.56 lb. per sq. ft. The weights in the table have been computed on that basis, allowing 1/32-in. additional for the bottom cover. Belt strengths in the table are based upon the total inches of duck in each belt, allowing a working strength of 20 lb. per inch for 28 oz. duck and 23 lb. for 32 oz. duck, the values accepted by most belt manufacturers. If necessary to use a still heavier duck, 36 oz. may be taken as 8.67% greater than 32 oz. Depending on the ratio of cost of duck and rubber, the cost of a belt with 36 oz. duck may or may not be the economical solution. Generally not, however, on account of the comparatively small increase in strength.

When belts of heavier duck or of more plies than are indicated in the table become

necessary, a more flexible construction such as the stepped ply should be used, or, as in one case that came under the author's observation, special low angle idlers installed instead of the present commonly accepted standards of 20 deg. for three pulley types and 15-30 deg. for the five pulley type. This, however, is expensive and in the case mentioned it was used because an extremely heavy load of abrasive material was handled and cutting the conveyor into two sections would have caused rapid wear of a very expensive belt.

Capacities of Belt Conveyors

It has long been recognized by many men in the industry that while the present capacity formulae give good results with narrow belts, 16 or 18 in., they do not give economically loaded conveyors in the wider

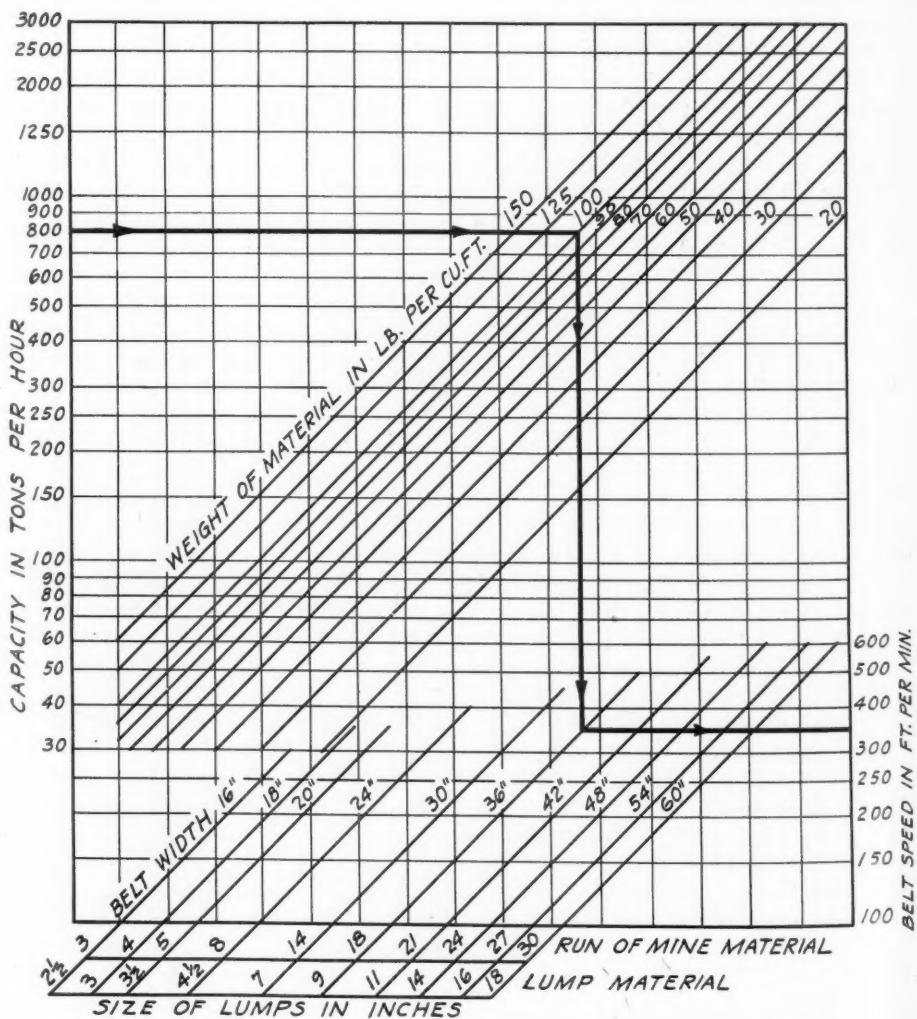


Chart for determining proper speed and width of belt conveyor

Rock Products

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sizes. At least four economic losses may result from this condition:

1. Wider and more expensive conveyors than necessary may be adopted.

2. When too wide a conveyor is used there is an increase in power due to the pull necessary to turn the greater weight of idler pulleys and terminal pulleys.

3. A wider conveyor than necessary results in a thinner stream and contact of a greater proportion of the material with the belt, hence greater belt wear per ton of material handled. This is increasingly serious in proportion with the abrasiveness and lumpiness of the material.

4. A belt that is obviously capable of carrying a greater volume without danger of spilling is a constant invitation to the operator to increase the load and few can resist the temptation, little realizing the damage that may be done. Tensile stresses in the belt may be increased anywhere up to 50% or more above what they should be for long life. Actual permanent stretching occurs and splices fail. Another serious result is increased abrasion due to the high tension. A tight string can be cut almost as easily with a dull knife as a slack one can be with a sharp knife.

Belt conveyor manufacturers all publish

formulae, tables or charts for finding the capacities of such equipment, based on an assumed cross section of material lying on the belt. The following five formulae are taken from the latest published data of five leading companies:

- 1—Capacity in cu. ft. per hr. at 100 ft. per min. = $3.2W^2$.
- 2—Capacity in cu. ft. per hr. at 100 ft. per min. = $3.5W^2$.
- 3—Capacity in tons per hr. of 50 lb. material at 100 ft. per min. = $8\%W^2$.
- 4—Capacity in tons per hr. of 50 lb. material at 100 ft. per min. = $8\%W^2$.
- 5—Capacity in cu. ft. per hr. at 100 ft. per min. varies from $3.0W^2$ to $3.42W^2$.

Formula No. 1 was undoubtedly the first one developed and others have been taken from it with variations to suit the judgment of the engineers of the various companies.

No. 2 is a parallel formula with a somewhat larger factor, giving about $9\frac{1}{2}\%$ greater capacity all through the range of sizes. It gives better loading for wider conveyors than No. 1 but results in loads on narrow conveyors that are liable to lead to spillage if the belts are not unusually well trained.

Nos. 3 and 4 give identical results with No. 1, the only difference being one of arrangement since dividing $3.2W^2$ by 40, the

cubic feet in a ton of 50 lb. material, gives $0.08W^2$.

The varying factors involved in No. 5 do not seem to follow a uniform law but do to a certain extent accomplish the results it is the purpose of the author to develop in a logical manner.

At the time formula No. 1 was developed belt conveyors were comparatively narrow as against a preponderance of wider conveyors today and results did not disclose the error of using for troughed conveyors a formula more applicable to the earlier flat type. That is, varying directly as the square of the width with simply a larger coefficient. A principal reason for failure to recognize inaccuracy of the formula was undoubtedly lack of means to determine with any degree of accuracy just what load was being carried until automatic scales such as the Weightometer came into use.

The error in any formula varying directly as the square of the width lies in the varying relation of width of stream to width of belt on properly loaded conveyors of different sizes. Starting with a 16-in. belt with the speeds and size of material that long use has shown satisfactory, an unloaded edge width of $2\frac{1}{4}$ - to $2\frac{1}{2}$ -in. will insure against spillage if the belt is properly trained.

With an uncovered edge of $2\frac{1}{4}$ -in. on a 16-in. belt the same ratio (which would approximately meet the W^2 formula) would give an edge distance of over 5-in. on a 36-in. belt, $6\frac{1}{4}$ -in. on a 48-in. belt, and practically $8\frac{1}{2}$ -in. on a 60-in. belt. These are obviously excessive even considering the larger lumps and faster speeds permissible with the wider conveyors. A wide conveyor can be kept trained (running straight) much more readily than narrower ones and results in practice show that a 5-in. edge distance is ample for a 60-in. conveyor to insure against spillage and give sufficient excess capacity to care for all ordinary surges.

A scale layout of a 60-in. conveyor with the load drawn in as starting 5 in. from the edge of the belt shows that with a depth of only 9 in. at the center the capacity will be 20% in excess of that given by formula No. 1. That this is a conservative load is well established by records of 60-in. conveyors handling overloads of more than 50%, 54-in. conveyors handling 45% excess and many 36-in. and 48-in. conveyors handling somewhat smaller percentages of overload. All were partially or totally inclined at the maximum advisable angles and running at what might be considered high speeds.

In the cases cited, however, the loading conditions were excellent and the belts carried about all that could be put on them, so that they were overloaded from the standpoint of good practice.

As stated previously, experience with narrow conveyors (16- and 18-in.) shows that formula No. 1 gives about the right results, particularly in view of the difficulties of training.

Two ways of modifying this formula in a

TABLE I. LIMITING PILES, WORKING STRENGTHS AND WEIGHTS OF BELTS
(Weight in lb. per lin. ft. of belt according to thickness of cover, and strength in lb. according to weight of duck used)

No.	Cover plies	Duck used	Width of belt in inches									
			16	18	20	24	30	36	42	48	54	60
3	$\frac{1}{8}$ -in.	.....	2.99	3.36	.....	.....	.....	.....	.....	.....	.....	.....
	$\frac{3}{16}$ -in.	.....	3.74	4.20	.....	.....	.....	.....	.....	.....	.....	.....
	28-oz.	9.66	1,080	.....	.....	.....	.....	.....	.....	.....	.....	.....
4	$\frac{1}{8}$ -in.	.....	1,104	1,244	.....	.....	.....	.....	.....	.....	.....	.....
	$\frac{3}{16}$ -in.	.....	3.35	3.78	4.20	.....	.....	.....	.....	.....	.....	.....
	28-oz.	4.11	4.64	5.12	.....	.....	.....	.....	.....	.....	.....	.....
5	$\frac{1}{8}$ -in.	.....	1,280	1,438	1,600	.....	.....	.....	.....	.....	.....	.....
	$\frac{3}{16}$ -in.	.....	1,470	1,654	1,840	.....	.....	.....	.....	.....	.....	.....
	28-oz.	1,600	1,800	2,000	2,400	3,000	.....	.....	.....	.....	.....	.....
6	$\frac{1}{8}$ -in.	.....	1,840	2,070	2,300	2,760	3,450	.....	.....	.....	.....	.....
	$\frac{3}{16}$ -in.	.....	5.12	6.18	7.70	9.24	.....	.....	.....	.....	.....	.....
	28-oz.	6.08	7.29	9.12	10.82	.....	.....	.....	.....	.....	.....	.....
7	$\frac{1}{8}$ -in.	.....	2,400	2,880	3,600	4,320	.....	.....	.....	.....	.....	.....
	$\frac{3}{16}$ -in.	.....	2,778	3,332	4,170	5,000	.....	.....	.....	.....	.....	.....
	28-oz.	6.72	8.40	10.06	11.76	13.44	.....	.....	.....	.....	.....	.....
8	$\frac{1}{8}$ -in.	.....	3,360	4,200	5,040	5,880	6,720	.....	.....	.....	.....	.....
	$\frac{3}{16}$ -in.	.....	3,864	4,822	5,800	6,770	7,730	.....	.....	.....	.....	.....
	28-oz.	9.12	10.92	12.72	14.56	16.38	18.18	.....	.....	.....	.....	.....
9	$\frac{1}{8}$ -in.	.....	4,800	5,760	6,720	7,680	8,640	9,600	.....	.....	.....	.....
	$\frac{3}{16}$ -in.	.....	5,500	6,620	7,730	8,840	9,940	11,040	.....	.....	.....	.....
	28-oz.	11.76	13.72	15.68	17.64	19.58	.....	.....	.....	.....	.....	.....
10	$\frac{1}{8}$ -in.	.....	6,480	7,560	8,640	9,720	10,780	.....	.....	.....	.....	.....
	$\frac{3}{16}$ -in.	.....	7,450	8,690	9,940	11,160	12,400	.....	.....	.....	.....	.....
	28-oz.	14.70	16.80	18.92	21.00	.....	.....	.....	.....	.....	.....	.....
11	$\frac{1}{8}$ -in.	.....	8,400	9,600	10,800	12,000	.....	.....	.....	.....	.....	.....
	$\frac{3}{16}$ -in.	.....	9,660	11,040	12,420	13,800	.....	.....	.....	.....	.....	.....
	28-oz.	17.92	20.18	22.38	25.40	.....	.....	.....	.....	.....	.....	.....
12	$\frac{1}{8}$ -in.	.....	10,560	11,880	13,200	14,440	.....	.....	.....	.....	.....	.....
	$\frac{3}{16}$ -in.	.....	12,150	13,770	15,180	17.42	23.80	25.40	28.00	.....	.....	.....
	28-oz.	23.92	26.60	29.32	32.00	14,910	16,540	18,180	20,800	.....	.....	.....
13	$\frac{1}{8}$ -in.	.....	15,600	17,940	.....	.....	.....	.....	.....	.....	.....	.....
	$\frac{3}{16}$ -in.	.....	28-oz.	32-oz.	.....	.....	.....	.....	.....	.....	.....	.....
	28-oz.	28.00	32-oz.	32-oz.	.....	.....	.....	.....	.....	.....	.....	.....

regular manner are open. First, by an arbitrary arithmetical progression, such as by adding a uniformly increasing percentage in proportion to the width, as, for instance, $\frac{1}{2}\%$ for each inch above 16 in., resulting in 22% increase on a 60-in. belt; or, second, by so changing the coefficient and exponent of W as to keep the 16-in. result about as it is and give a 20 or 22% greater result for the 60-in. belt. Expressed as formulae these two methods are thus:

No. 6—Capacity in cu. ft. per hr. at 100 f.p.m.
 $= 3.2W^2 + \frac{1}{2}\%$ per in. above 16 in.
 No. 7—Capacity in cu. ft. per hr. at 100 f.p.m.
 $= 2.1W^{2.15}$.

From the nature of the problem it would seem to be more nearer exponential progression than an arithmetical one and therefore No. 7 should best satisfy the conditions in giving a logical variation to the expression. It gives about 21% increase on a 60-in. belt and a very slight decrease on a 16-in. belt.

Table II shows comparative capacities for all seven formulae. It indicates that there is little to choose between No. 6 and No. 7 in actual results. No. 7 following one definite and simple law, however, would seem to be preferable for that reason if for no other.

TABLE II. CAPACITIES OF BELT CONVEYORS BY VARIOUS FORMULAE

Width in inches	Cu. ft. per hr. at 100 ft. per min. belt speed				
	Nos. 1, 3 and 4	No. 2	No. 5	No. 6	No. 7
16-in.	820	896	768	820	815
18-in.	1,036	1,134	978	1,047	1,050
20-in.	1,280	1,400	1,218	1,300	1,317
24-in.	1,842	2,016	1,770	1,920	1,948
30-in.	2,880	3,150	2,880	3,080	3,148
36-in.	4,147	4,536	4,170	4,570	4,660
42-in.	5,645	6,174	5,820	6,380	6,489
48-in.	7,373	8,064	7,680	8,540	8,648
54-in.	9,331	10,206	9,900	11,150	11,140
60-in.	11,520	12,600	12,300	14,050	13,971

There is some little range of choice in widths and speeds to give a desired capacity, but, first, consideration must be given the size of lumps. The loading chutes should not be more than two-thirds the width of the belt and preferably narrower if straight sided skirt plates are used with "garner plates" behind to concentrate the load and no "choke strips" along the skirt plates. This fixes the size of the opening because if the lumps are too large the chute is likely to become clogged and cause damage. Table III gives a conservative list of sizes of lumps that can be handled on the various widths of conveyors.

TABLE III. LIMITING SIZES OF MATERIAL ON BELT CONVEYORS

Width of belt in inches	Max. size lumps in inches	
	Run of mine material	Lump material
16	3	2 $\frac{1}{2}$
18	4	3
20	8	4 $\frac{1}{2}$
24	8	4 $\frac{1}{2}$
30	14	7
36	18	9
42	21	11
48	24	14
54	27	16
60	30	18

In this table "run of mine" is used as a term best describing material that has had none of the fines removed and "lump" as material that has had the smaller sizes screened out, no matter whether from a mine or crusher.

If the size of the material does not control the width of the conveyor then the speed will and the limiting speeds given in Table IV should not be exceeded.

TABLE IV. LIMITING SPEEDS OF BELT CONVEYORS

Width of belt in inches	Max. speed in ft. per min.
16	300
18	350
20	350
24	400
30	450
36	500
42	550
48	600
54	600
60	600

The question as to whether or not these limiting speeds should be used will depend upon the nature of the material. If breakage of material is an item, as with coke or anthracite coal, the speed should be kept low, 200 ft. per min. for coke and 250 to 300 ft. per min. for anthracite coal, using the slower speed for the more valuable sizes. If lumpy or abrasive material is to be handled, the speed should be conservative in order to save belt wear, as even with the best of chute design it is impossible to deliver the material to the belt so as to eliminate all impact and acceleration forces.

About two-thirds of the limiting speeds might be considered as a good average for lump or abrasive material. If the material is of a light, fluffy nature excessive speeds are liable to cause windage losses. In fact, sand and the smaller sizes (under 2 $\frac{1}{2}$ - or 3-in.) unscreened of other materials are the only ones where it is advisable to use limiting speeds.

Some engineers advocate a reduction of capacity allowances on inclined conveyors, but in the author's experience this theory does not hold in practice unless the inclination is so steep as to cause actual backward sliding of the material, or the speed is so fast that the material cannot come to rest quickly on the belt at the loading point. A normal cross section once at rest at the belt speed cannot change except by sliding or rolling.

Lumpy materials are the most difficult to load at the higher speeds and a slight reduction of the angle of inclination at the loading point on inclined conveyors will make a considerable improvement with slight loss of rise for a given length.

The accompanying capacity speed chart developed by the author some 20 years ago embodies the principal features of the preceding in a practical and easily comprehended manner. This chart corresponds to formula No. 7.

(To be continued)

Cement Markets of Argentina

THE OUTPUT of the Argentine cement plants supplies less than 50% of the country's demand for cement. Consumption amounted to 4,761,313 bbl. in 1929, and to 4,345,550 in 1930. For earlier years, records show that the domestic industry supplied 464,696 bbl. of 1,196,398 consumed in 1920, 778,231 of 2,596,934 consumed in 1925, and 1,367,785 of 3,860,733 consumed in 1928.

The general prosperity of Argentina and especially the development of building construction is reflected in the consumption of portland cement. In pre-war years it rose to 2,638,350 bbl., or over 132 lb. per capita. The depression caused by the war, combined with the high prices for cement, reduced consumption until in 1918 it was 501,287 bbl., or 26 lb. per capita. Since that time it has been steadily increasing to its present level. During 1930 there was a drop in consumption due to unfavorable economic conditions, but there seems to be no doubt that consumption will steadily mount again with improvement in general conditions. Estimated per capita consumption has increased from 95 lb. in 1924 to 99 in 1925, 114 in 1926, 125 in 1927, and 136 in 1928.

Argentine imports of portland cement reached their peak for recent years in 1927. Sources are not available for imports received in 1930, but a total of 2,046,652 bbl. of portland and 81,290 of white cement is recorded for that year.

The principal receiving ports for imported cement are Buenos Aires, Rosario, and Santa Fe, from which the entire country is served.

There are no exports of cement from Argentina.

There are no agreements between local producers as to territory, production, or prices, and no special concessions to domestic industries except that frequently in the case of government construction it is specified that preference will be given to local products.

There is a tendency in Argentina toward increased use of cement for paving, building, and roads.

Plans are projected for construction of large grain elevators throughout the agricultural sections, and for warehouses for fruit. The various provinces have under consideration extensive public work programs including paving, road building, and port work.

Part of the increased demand which is expected will be met by heavier production within the country through new and enlarged plants.

American brands sold in this market are highly regarded, and have only price competition to overcome. For some years they have been a negligible part of imports.

The above, and information on prices, import charges, local production, credit terms and transportation, are contained in Special Circular 18 of the Minerals division of the Bureau of Foreign and Domestic Commerce.

Hydraulic Dredge With New Design Features

Koenig Coal and Supply Co., Oxford, Mich., Installs New Hydraulic Pump Dredge for Sand and Gravel Excavation

By Bradley S. Carr, M. E.*

THE KOENIG COAL AND SUPPLY CO., a large producer of commercial sand and gravel, with general offices at Detroit, Mich., now operates two complete and modern plants at Oxford, Mich. Early in 1931, at its new "B" plant, the company put into operation a new pump dredge which typifies latest accepted practices. Many of the improved designs were evolved from experiences at plant "A," where for a number of years similar dredge equipment has been used.

The new design was worked out to meet both the immediate and the future deposit

*Manager Pump Department, American Manganese Steel Co., Chicago Heights, Ill.

conditions. The deposit is an old glacial area with an abundant supply of water. Above water level the thickness of the deposit varies from 10 to 25 ft. Below water level, the thickness varies from 30 to 45 ft. near the screening plant and where the present excavating is done, but the deposit gradually slopes downward to areas of from 50 to 60 ft. in depth farther away from the screening plant and which will have to be worked in the future.

The sand particles are of irregular cleavage plane structure, making sharp sand, and the gravel varies in size from commercial sizes, which require grading by screening only, up to pieces 4 in. in diameter and

larger. The materials are of heavy structure, particularly suited for concrete work. The deposit also includes pockets of oversize pieces ranging from 8 to 12 in. in diam., with occasional irregular boulders 15 to 30 in. in maximum dimension.

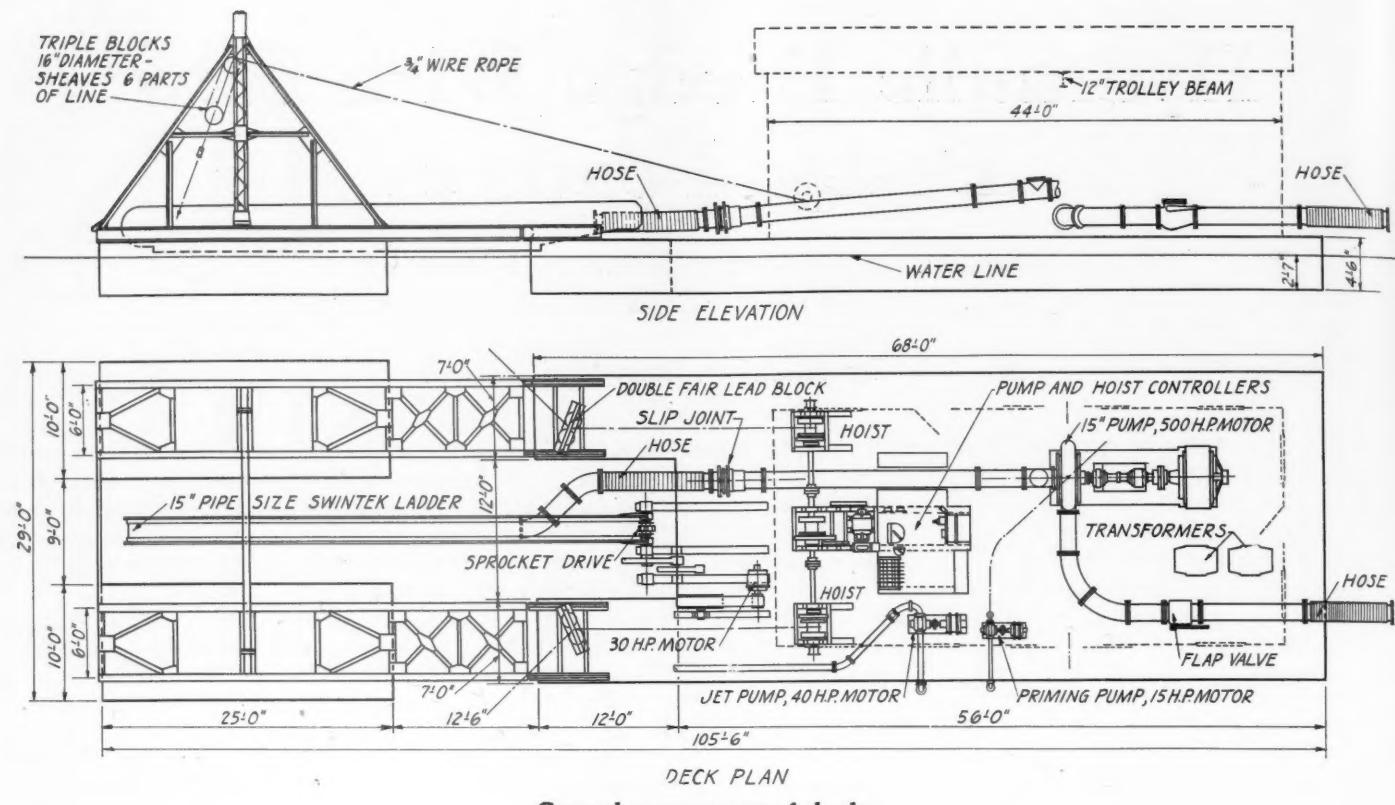
The dredge is of rugged construction throughout to cope successfully with this hard digging and to withstand the constant abrasion of the materials dug.

Designed for Easy Field Assembly and Future Lengthening of Ladder

The design of the dredge as a whole is unique in that the owners desired steel construction throughout with a minimum of field



General view of dredge with ladder in raised position



assembly and so planned that it could be assembled by the local plant crews, a minimum of freight shipping expense, and a semi-portable construction which would permit ready disassembly, moving and reassembly, should that be required by some future program.

A digging ladder of proper length for the immediate deposit was required, with provision for adding suitable ladder length for future greater depths of excavation, and with the structure supporting the ladder so constructed that it would accommodate the loads of the two ladder lengths. In the final design all of these required features were met along with sturdy construction for the loads involved with a minimum investment.

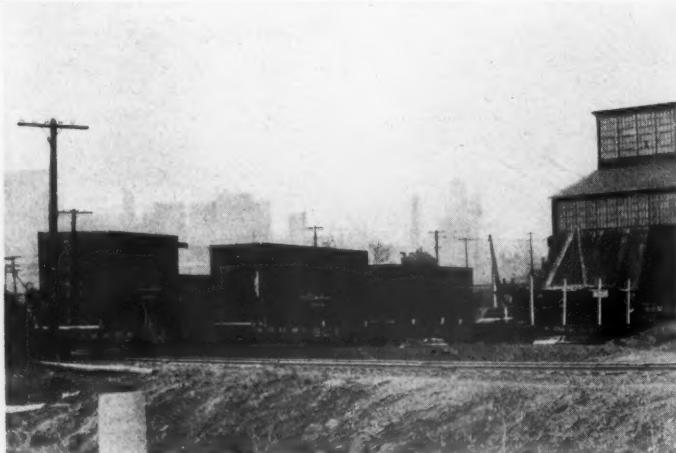
The general design comprises a main hull with a forward well for the ladder, and two

pontoons with a fixed "A" frame structure which are joined to the main hull by a set of four stringer members using pinned connections. Hinged pontoons are used instead of a rigid structure to give a free connection and to reduce the movement and stresses resulting from varying ladder loads and bank cave-ins.

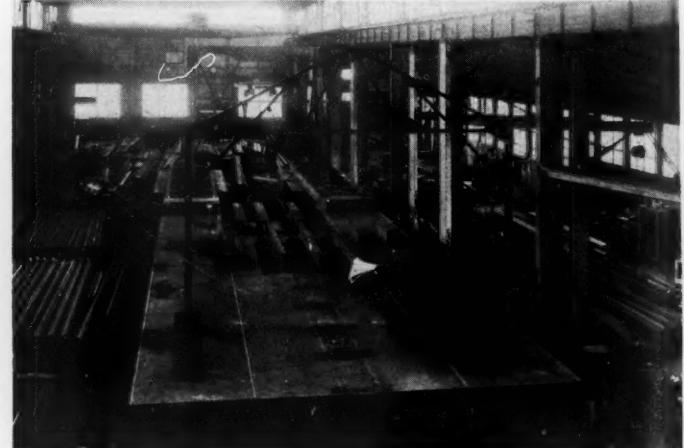
The main hull consists of four pontoon units of water-tight steel plate construction, which were assembled with heavy diaphragms of special plate and angle construction. The two aft pontoons are each 33 ft. long by 12 ft. wide by 4½ ft. deep, of rectangular shape with square corners. The two forward pontoons are the same except that the inner forward ends of each are recessed to form the ladder well. The spacing between the pontoons for diaphragm width is 2 ft. 0 in.,

so that the assembled hull measures 68 ft. long by 26 ft. wide.

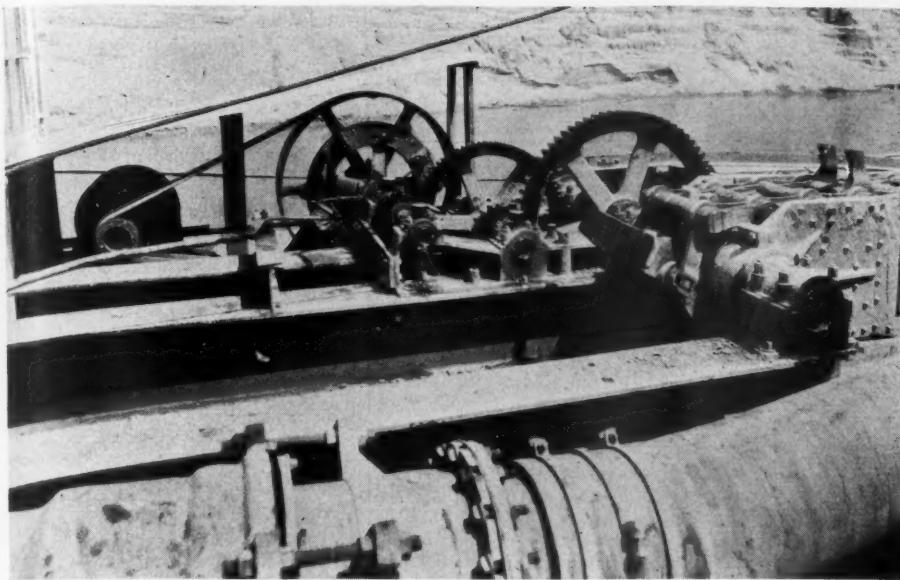
The ladder well at the forward end is 12 ft. long by 12 ft. wide. Each pontoon has ample internal bracing, all seams were double riveted in the shop and all outer plate edges of the seams were calked. Each pontoon has a round manhole and bolted cover and was coated with hot asphaltum paint on the inside. Heavy angles and plates of boxed construction with semi-finished bolts in reamed holes were used in connecting the pontoons, resulting in a rigid hull and permitting the field assembly to be readily done by the local crew. This construction gives strength and stiffness equal to a single unit which, however, would have required many hours of field riveting by special erection crews.



Units loaded for shipment showing compactness and portability



A complete assembly in the shop was made before shipment



Driving mechanism for traveling chain on ladder

The builders made a complete shop assembly, carefully marking all connections and thus insuring correct field assembly. One of the illustrations showing the shop assembly also shows construction details and the heavy "H" beams and "I" beams used for the hoist supports. The compactness and ease of transportation of the units is indicated in one of the other illustrations.

Pontoons Large Enough for Increased Ladder Length

The two forward outrigger pontoons are each 25 ft. long by 10 ft. wide by 4½ ft. deep and of the same water-tight tank construction as the main pontoon units. They are located 9 ft. apart and 12 ft. 6 in. ahead of the main hull, giving suitable clearance for the 45-ft. ladder and making an overall length of 105 ft. 6 in.

The ladder was designed so that an additional 20 ft. can be added for future digging requirements. When the ladder length is increased the connections to the outrigger pontoons can be correspondingly increased by 20-ft. structural sections. The assembly of the forward outrigger pontoons gives a simple, rigid structure. The members are of "I" beams with heavy cross bracing.

The "A" frame is of heavy, rectangular construction, having legs of latticed channel column section, which are braced fore and aft by heavy, double angles from the tops of the columns to the stringer frames at the ends of the pontoons. Similar bracing is used for inner lateral support of the "A" frame reaching from the bases of the columns to the center position of the head block. This framing was shop riveted and arranged for field assembly by using bolts fitted reamed holes for all major connections.

The entire structure is built to carry all future loads requirements and the forward pontoons are of ample size to give proper

buoyancy for future loads when a longer ladder is used. To give the proper elevation to the pontoons for the present ladder load they have been partially filled with water which will be removed when the future additional ladder loads are applied. This buoyancy control feature of the outrigger pontoons, together with the good weight distribution of the entire dredge assembly, provides practically "trim ship" to the entire installation for both the raised and lowered positions of the ladder.

The cabin is of structural steel, sided and roofed with galvanized corrugated metal sheeting. In its framing, provision was made for handling the equipment by placing "I" beam tracks and a trolley and chain hoist over the pump and motor and over the pump

shell position from side to side of the main hull. A similar chain hoist and track arrangement is placed over the drum hoists.

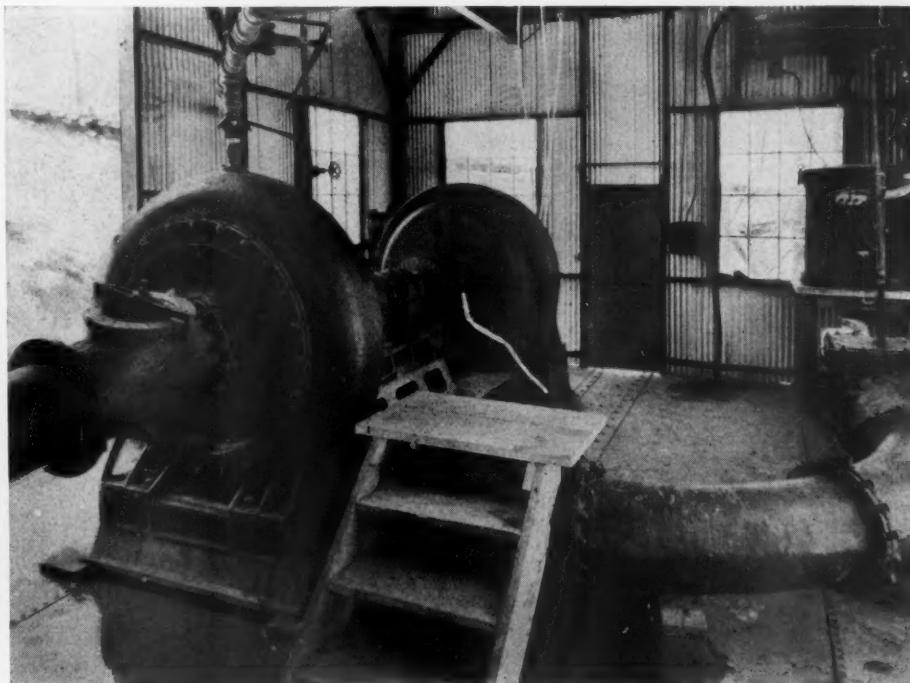
Ample light is provided by having the entire front end fully sashed and the sides and aft end equipped with large windows. Heavy sliding doors are used on the sides to accommodate the "I" beam trolley track. Roof ventilators provide proper ventilation and the cabin is roomy, with comfortable inside aisle spaces and outside walkways.

Ladder Details

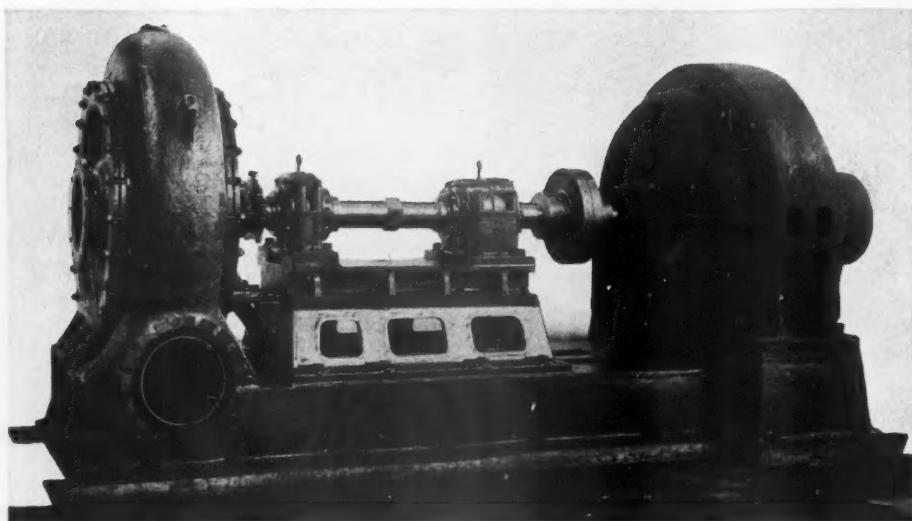
The ladder is a heavy structural steel frame 45 ft. long with an Eagle "Swintek" traveling chain screening nozzle and a 15-in. pipe line. The traveling chain, driving sprocket and track liners are of Amsco manganese steel to resist abrasive action.

Heavy duty chain of 12-in. pitch, with 7-in. by 9-in. openings, permits solids of these maximum dimensions to enter the suction line. The speed of the chain is approximately 40 ft. per min. Large outcurved digging arms attached to the chain give powerful digging ability and also provide for the removal of oversize pieces from the nozzle, thus permitting practically uninterrupted digging, regardless of the varying nature of the deposit.

The suction line has only a slight offset between the nozzle and the pump of two long radius bends to permit the pipe to pass around the driving sprocket. A length of suction hose gives flexibility to the suction line at the hinge or drive shaft position. From this point the suction pipe is straight and slopes upward to the pump opening, where a large handhole fitting, with a slight elbow curvature at one end, connects the pipe line to the pump. The arrangement gives



Assembly of pump and motor showing part of the piping



Shop assembly of manganese lined pump and motor showing arrangement of anti-friction bearings

maximum freedom of flow of water and materials.

A 30 hp. squirrel cage motor is used to drive the traveling chain on the ladder. Short pulley centers for the belt drive are permissible because the motor has the Rockwood rocker base type of drive. The sprocket shaft is 7 in. in diameter.

The ladder frame trunnions ride on spool shaped journal extensions of the drive shaft bearings, which makes them independent of the shaft. All bearing parts and gears are carbon steel castings. The bearings are of unit block construction and the gears have accurately cut teeth.

The pulley driving the gear train has a safety friction clutch which can be released by a bell crank leverage mechanism from the operator's position. The motor is also provided with an overload safety current throw-out device should the clutch fail to slip under any unusual digging loads.

The 15-in. Amsco heavy duty pump is equipped with S.K.F. anti-friction bearings and is direct-connected to a 500 hp. Allis-Chalmers fully encased slip ring motor. This motor operates at 505 r.p.m. on 3 phase, 60 cycles, 4600 volt current and is equipped with a continuous duty resistor and drum type controller for 50% speed reduction. A Francke flexible coupling is used between the pump and motor. The pump and motor unit with its electrical controls gives full flexibility over a wide range of operating conditions.

The pump shell is provided with renewable liners and the impeller is attached to its shaft by a tapered bore and auxiliary lock nut. The main bearings are dowel pinned and bolted to a pedestal which can easily be moved in a direction parallel to the axis of the shaft by means of a screw adjustment on the coupling end of the pedestal.

The bearing next to the pump is a self-aligning heavy duty radial type of S.K.F. roller bearing. The other is a combination unit comprising a similar roller type radial

bearing supplemented by a deep groove, ball bearing type of thrust bearing. The shaft between the bearings is provided with a hexagon nut portion so that when required the shaft can be blocked with a heavy wrench. This nut portion of the shaft is protected by a safety cover bolted to the carriage.

Dressed oak wood sills 2½ in. thick are used between the deck and the pump base to provide auxiliary cushion mounting. The pipe line fittings are all of standard 15-in. Amsco design, made of manganese steel to insure maximum service.

Portions of the bank require preliminary breaking down and sluicing with high pressure water monitor jets and a high head, 4-in. by 3-in. centrifugal water pump driven by a 40-hp. motor has been provided to handle both the jet work and the priming of the dredge pump. These monitor jets are

shown in one of the illustrations and in another is shown the ejector piping connections with the quick acting valves used at the pump.

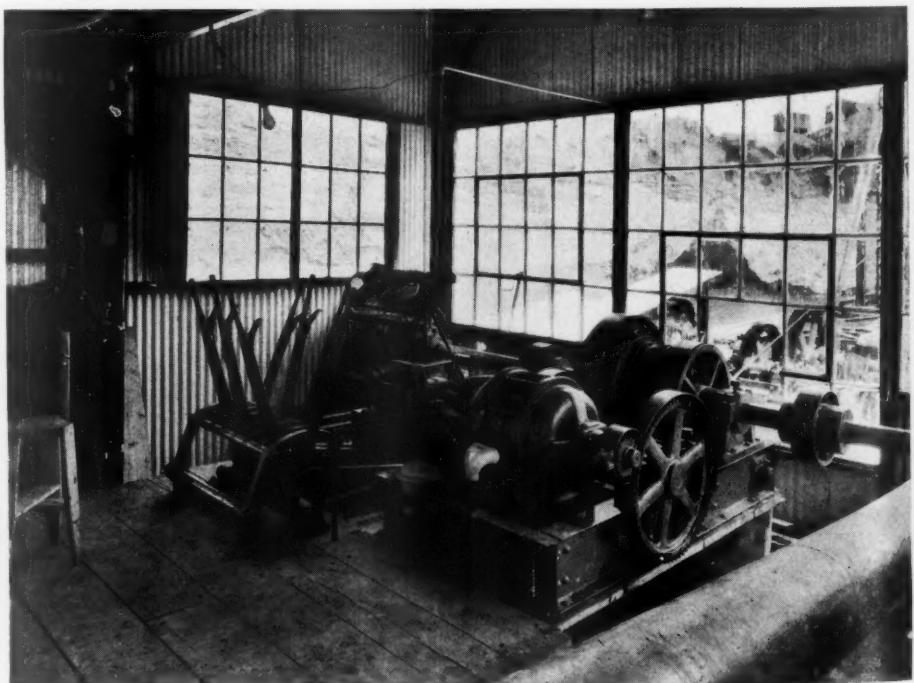
The hoist is a special Thomas heavy duty, three-drum hoist powered by a 40 hp. slip ring motor which is provided with variable speed control and a solenoid brake. The middle drum is used for raising and lowering the ladder and employs 3/4-in. wire rope with six parts of line.

The outer drums have 5/8-in. diameter wire rope lines and are used for swinging and moving the dredge. The hoist shaft extends through and beyond the cabin siding to accommodate nigger heads for manila rope lines. Dressed oak sills are used between the hoist base and the structural "I" beam supports on the deck.

One of the illustrations shows the careful planning as to the arrangement of the operator's platform and centralized controls to give compactness without cramped quarters. The location of the hoist lever quadrant stand, the lever for ladder clutch control, the board mounting the dredge pipe line pressure and vacuum gages and ammeter for the dredge pump motor and the controller for the hoist motor with overhead bracket mounted resistor are shown. The dredge pump motor controller, with overhead bracket mounted resistor, and oil switch panel are placed at the rear of the operator's platform. The operator's platform is of heavy dressed planks elevated so that he has a clear view of the entire bank being worked.

The discharge pipe line is carried on pontoons from the dredge to the shore and then overland to the discharge point on shore, where the materials are scrubbed, washed, crushed and classified with complete and modern screening plant equipment.

All dredge equipment is individually pow-



Interior view of forward end of cabin showing operator's position and controls

ered by electric motors, thus ensuring maximum flexibility of operation and economy. Electrical energy at 4600 volts is brought to the dredge from a shore transformer station by wires mounted on poles carried by the discharge pipe line pontoons.

All other motors than the dredge pump operates on 440 volts and this voltage is obtained from a transformer on the dredge. The lights are operated on 115 volts, which is obtained from a second transformer connected with the 440-volt lines. The dredge electrical installation has been made in a thoroughly approved manner with all wiring in conduits, giving maximum safety.

General

In the design and construction of the dredge boat thought was given to proper light and ventilation, a practical deck plan, efficient units and ample power units so that the dredge, as a complete digging tool, is equipped to meet in a practical way the local deposit conditions. The operator has full control of the entire installation with the minimum expenditure of effort on his part.

The engineers of the dump department of the American Manganese Steel Co. worked out the design of the dredge and supervised its construction, cooperating with the owners in the selection of all equipment. Glen Waite, engineer for the owner, supervised the field erection and installation and aided in numerous suggestions as to the entire design. All structural steel work, with the exception of the ladder frame, was designed and constructed by the Pittsburgh-Des Moines Steel Co. at its Des Moines, Iowa, plant.

This was done in cooperation with the general plans and equipment arrangements formulated by the Amsco engineers. Much credit is due that company's designing engineer, E. Harris, for the numerous new boat features of design and the thoroughness of detail reflected in the finished product.

This dredge has proven to be a most practical and economical excavating machine.

Issues Annual Report of the Bureau of Standards

THE ANNUAL REPORT of the director of the Bureau of Standards has been issued.

This report summarizes progress of work under way during the year. Those of interest in the rock products field include: Absorption coefficients of acoustical materials, tests of corrugated cement-asbestos roofing, durability of concrete aggregates, cast stone, waterproofing compounds, aggregates for cinder concrete building units, moisture penetration through brick and mortar, durability and strength of bond between mortar and brick, clay admixtures in concrete, cement, lime, gypsum, sand-lime brick, building stone, slate, masonry cements, the cement reference library, branch laboratories and inspection of cement and fire tests of partitions.

To Hold Operators' School on Ceramic Firing

THE Ohio State University Engineering Experiment Station, Columbus, Ohio, proposes to hold a conference on firing at the Roseville experimental plant, the Ohio State University, December 17, 18 and 19. The following program has been outlined:

Fuels—Professors H. E. Nold and E. V. O'Rourke.

Combustion—Professor D. J. Demorest.

Flue Gas Analysis—W. E. Rice and C. A. Austin.

Kiln Draft and Heat Distribution—Professor J. L. Carruthers.

Pyrometry—T. A. Kleinfelter and G. A. Bole.

Kiln Firing—C. B. Harrop and F. M. Hartford.

Research in Kiln Firing—W. E. Rice and C. A. Austin.

The course is planned to be of greatest benefit to plant operators. The work leads up to a report on the research work which has been carried on for two years by the Engineering Experiment Station in cooperation with the Federal Bureau of Mines, Fuel Division.

The lectures will in each case be followed by laboratory and plant demonstrations. At Roseville an elaborate equipment for kiln tests has been set up in which coal is fired in two types of stokers, and on dead bottom and horizontal grates in hand-fired furnaces. The gas firing of periodic kilns will also be demonstrated.

It is expected that this will be a fine opportunity for plant men to get needed fundamental information in regard to fuels, combustion, methods of firing and the control problems involved in the burning of ceramic wares. A discussion will follow each lecture period. The course is planned to interest those firing any type of fuel in any type of kiln, whether the ware be fine wares or structural clay wares. Visits will be made to plants firing structural clay wares, tile, stoneware and tableware and the firing system explained in light of the information given during the lecture and laboratory period.

Everyone is invited and no charge will be made for the conference. Anyone interested may get in touch with G. A. Bole, Lord Hall, O.S.U., Columbus, Ohio.

Complete the Organization of Mississippi Cement Co.

REPORTS from Jackson, Miss., state that organization of the Mississippi Portland Cement Co. has been completed, and plans are being formulated for the building of a plant. The company is to have capital of \$1,500,000 and officers were announced in the November 21 issue of ROCK PRODUCTS.

Three years ago a company by the same name was formed in Mississippi and plans announced for the building of a plant, but nothing was done at that time. There is no cement plant in Mississippi at present.

Plan Development of Marble Quarry in Michigan

DIAMOND DRILLING has been started on the quarry of the Vertique Marble Co., a few miles to the northwest of Ishpeming, Mich. The work is being done by the contract department of the Sullivan Machinery Co., Chicago. It is contemplated to put down three holes to a depth of about 100 ft. to test out the soundness of the deposit of verde antique. It is believed that it will be found to be of commercial grade. Drills which penetrated the deposit on the Carter quarry, to the east, encountered more than 300 ft. of sound marble.

Representatives of the company state that the company is amply supplied with funds to go ahead with the development program. A syndicate has been formed in Detroit and it is not intended to have a stock sale at this time.

The following officers have been appointed by the syndicate: President, J. W. Brussel, works manager, Timken Detroit Axel Co.; vice-president, P. L. Wiebur, manager forge department, Timken Detroit Axel Co.; treasurer, Clark C. Wickey, assistant to the president, Detroit Dock Exchange; secretary, C. H. Sheppherd; directors, F. H. Brussell, president, Central Manufacturing Co.; Earl Frost, National Machinery Co., and J. R. Williams.

W. S. Lincoln, a practical quarry operator, has arrived from Massachusetts and is the local superintendent for the Vertique company. It is desired to get started on quarrying just as soon as possible, as it is known that a market has been created for the product. Weather rock that is not sound is to be crushed and sold for terrazzo and the sound blocks will be forwarded for cutting and polishing.

The required machinery is on the property and an electric line was installed by the Cliffs Power and Light Co.—Ishpeming (Mich.) Iron Ore.

Plan Loading Facilities for Gypsum Export in California

CALLING at San Diego, Calif., to lift a 1600-ton shipment of gypsum for delivery in the Philippines, the freighter *Golden Wall* of the Oceanic and Oriental Navigation Co.'s fleet, was expected to arrive about November 17.

The gypsum, which will be used in a plaster mill in the Philippines, is to be sent from Plaster City, some of the shipment being loaded already. Car-to-ship arrangements are now being completed.

The *Golden Wall* will be the third vessel of the O. and O. fleet to call at San Diego, the *Golden Horn* and *Golden River* having preceded her in the handling of the local gypsum.—San Diego (Calif.) Union.

Will Exhibit at Century of Progress Exposition

THE Associated Tile Manufacturers, Inc., has signed a contract for construction of a residence built inside and out of tile, to be shown as part of the housing exhibit of A Century of Progress Exposition, Chicago's 1933 World's Fair.

This is the first contract signed for the construction of a building in the housing group. It is believed that this will be the first time in history that a residence will be constructed completely of tile.

According to present plans, the Associated Tile Manufacturers will erect a house which will fill the most modern needs of a small family. One of the things which it is hoped to illustrate will be the correct use of tile on the exterior and especially on flat terraced roofs in a decorative way which will enhance the building's aerial view. The practical application and specific values of various types of tile will be demonstrated.

Other groups of building material producers and large individual units in the industry are making plans to erect buildings in the housing group to demonstrate the uses of their materials to the millions of visitors to the 1933 World's Fair.

In the construction of the buildings, two courses will be open. The works department of A Century of Progress may draw up plans for the building and erect it at the Exposition's expense, charging the producer of the materials a rental for the grounds space. Or the company providing the materials may engage its own architect and erect the building at its own expense, with the approval of A Century of Progress. In the latter case, no rental charge for ground space will be made.

Asphalt Road Construction

MANUAL No 1, discussing road-mix types of asphalt road construction, has been issued by the Asphalt Institute, New York, N. Y.

Subjects included in this manual are definitions of road-mix types, types of construction, selection of appropriate types, conditioning existing surface for road-mix top, labor, equipment and tools, construction of graded aggregate wearing course, construction of the macadam aggregate type, developments in low cost plant-mixing, material tests and control of mixtures, and service and cost of road-mix types.

Graphite in 1930

THE U. S. Bureau of Mines has issued a report on the production, uses, prices, and imports and exports of graphite in the United States in 1930. Data are also given on world production of graphite.

Canadian Cement Products Industry in 1930

MANUFACTURERS of cement products in Canada were valued at \$3,718,704 in 1930. Records of the Dominion Bureau of Statistics at Ottawa, which are available since 1919, show that the production of cement products totaled \$921,478 in 1919, advanced to \$1,527,590 in 1920, then dropped slightly during the next few years to \$1,257,871 in 1924. Output again swung upward in 1925 to \$2,020,239, and continued to gain each year until the peak value of \$4,419,417 was attained in 1929. The total of \$3,718,704 reported for 1930 was 16% under this record and marked the first recession in six years.

Ontario with 88 plants accounted for 51.7% of the total business; Quebec with 33 plants made 30%; British Columbia with 10 plants made 10.6%; Saskatchewan with 3 plants made 3.8%; Alberta with 3 plants made 1.9%; and the remaining 2% was produced by three plants in each of Nova Scotia, New Brunswick and Manitoba.

These 146 plants reported working capital of \$5,157,051 and afforded employment to a monthly average of 1,252 people who received \$1,414,043 as salaries and wages. Materials for manufacturing cost \$1,261,910 and the value was \$2,456,794.

Principal products included sewer pipe and culvert tile worth \$1,137,642, artificial stone at \$877,659, cement building blocks at \$802,604, cinder blocks at \$273,097, cement bricks at \$129,409, and miscellaneous goods such as drain pipe, cement stucco, laundry tubs, burial vaults, etc.

Alex W. Dann Elected Vice-President Mississippi Valley Association

THE Mississippi Valley Association, representing 24 states of the United States, meeting in St. Louis, Mo., November 24, elected Alex W. Dann, president and general manager of the Keystone Sand and Supply Co., Pittsburgh, Penn., a regional vice-president. Mr. Dann is a past-president of the National Sand and Gravel Association and has always been prominent in the councils of the sand and gravel industry. He is also an officer of the Dravo Contracting Co., Pittsburgh, builders and operators of river barges.

Silica in 1930

A REPORT on the production of quartz and ground sand and sandstone, the imports, and names of producers is given in a bulletin issued by the Department of Commerce. The report was prepared by E. R. Phillips. It is the section to be included in Part II of Mineral Resources of the United States, 1930.

U. S. Road Funds Seen as Work Stabilizer

"FEDERAL FUNDS for road building is one of the greatest stabilizing factors in the current business period," W. C. Markham, executive secretary of American Association of State Highway Officials, declared recently.

Attention was called by Mr. Markham to the employment of over 350,000 men in building roads on the state highway systems, in 1931, remarking that "although federal aid embraces only about one-tenth of the money actually spent in state road betterment the effect of this federal assistance was to stimulate the states to much greater activity than if little or no federal aid had been granted."

"It is indeed fortunate that federal monies will be extended on a fairly large scale during coming years," said Mr. Markham. "On the other hand it would be distinctly unfortunate if federal cooperation were to be reduced in any degree, for the history of state road building shows that not only has federal aid led the states to think in progressive terms but also to throw more energy and devote more money to road building than they would otherwise have done. Business conditions are such that public construction as a bulwark against unemployment is vividly revealed."

Asphalt Technologists Meet to Discuss Low-Cost Highways

DETAILS of low cost highways to connect the main-traveled roads with paved byways as well as to relieve unemployment through a wide distribution of jobs will be the principal subject at the meeting of the Association of Asphalt Paving Technologists on January 15 during the 29th Annual Convention and Road Show of the American Road Builders' Association in Detroit, Mich.

Mineral fillers, the cracking of pavements due to weather changes, and modern improved paving practice will be considered by committees. Addresses will be heard on the surface relation between asphalt films and mineral aggregates, the adaptation of the stability test to coarse asphaltic paving mixtures, and on other subjects chiefly of interest to asphalt producers, engineers and road builders.

Stanford T. Crapo Director of Federal Reserve Bank

STANFORD T. CRAPO, secretary and treasurer of the Huron Portland Cement Co., Detroit, Mich., has been reelected a class "B" director of the Federal Reserve Bank of Chicago. His term of office expires December 31, 1934.—Michigan Contractor and Builder.

Molding Sands

FROM the geological standpoint a perfect sand has all its grains of one uniform size. Pure sands of this type are particularly valuable for glass making. Freedom from impurities which may have a fluxing action is also necessary in sand for metallurgical purposes, such as the making of the hearth or bath in the acid open-hearth steel furnace.

For the production of molds in which metals are cast, W. J. Rees said before the British Institute of Quarrying that it is desirable that the sand should consist mainly of quartz grains of medium size, but these grains should be coated with a refractory clay which will act as a bond, the *British Contract Journal* reports. The presence of any large proportion of intermediate size grains and silt is detrimental, as it tends to clog up the sand and reduce its permeability. A molding sand which possesses a useful natural bond will take up from 3 or 4% to as much as 10% of water. When moist it will stand up firmly to any required shape and will not lose that shape or become crumbly or partial on complete drying. The presence of hydrated iron oxide in the bond is valuable, as it increases the life of the sand, owing to its slower rate of dehydration as compared with a pure clay bond.

In evaluating a molding sand it is necessary that information on the following points should be obtained:

- (1) Chemical composition and refractoriness.
- (2) Mechanical composition or grading.
- (3) Strength.
- (4) Permeability.

There is an obvious connection between chemical composition and resistance to the effects of high temperature, or refractoriness, as the higher the proportion of fluxing impurities such as mica, feldspar, clay, lime and magnesia compounds, the lower will be the fusion range of the sand.

As a molding sand is a mixture of minerals having different softening and fusion points, for each sand there is a range of temperature between the beginning of softening of the least refractory constituents to the fusion of the quartz grains themselves. The actual grain size has some effect on its refractoriness, the coarser grains being more resistant to the effect of heat and of contact with fluxing impurities than the finer grains.

Plans Progress for Fort Scott Hydraulic Cement Plant

PLANS ARE IN PROGRESS in the office of Charles A. Smith of Kansas City, Mo., for the rebuilding of the Fort Scott Hydraulic Cement plant in Fort Scott, Kan. Howard Thomas is in charge for the plant. Details cannot be given at the present time. The architect would like to have information regarding machinery and equipment.—*Kansas Construction News*.

Illinois Geographical Survey Welcomes Problems

AT A MEETING of the Chicago section of the American Institute of Mining and Metallurgical Engineers, November 18, Dr. M. M. Leighton, chief of the Illinois Geological Survey, told of the work of this state bureau. At a time when many states are reducing appropriations for such work, Illinois has passed a special appropriation to cover a two year period and which more than doubles the funds heretofore allotted to the survey and places it at the top of such organizations throughout the country. This has made it possible to add five specialists for work in chemistry, physics, microscopy and geophysics.

Research is to be conducted on the fundamentals of Illinois' formations and structures with a view to determining the exact constitution—chemically and physically—of every mineral of commercial importance. It is thus hoped to ascertain why competing minerals or rocks from other states are interfering with local productions. All the nonmetallic minerals will be studied. Clays will be given microscopic investigation to ascertain, if possible, why two deposits of seemingly identical quality yield totally different commercial results. It is proposed to learn why limestone from northern Michigan is competing successfully with the limestones of Illinois in the steel works and cement plants at the foot of Lake Michigan. The limestones of Illinois will be studied also with a view to proving their commercial value as a building material.

As an example of some of the work being done, the fluorspar deposits in Hardin county are deeply mantled with beds of clay so that prospecting for fluorspar outcrops has always been difficult. With an electrical-resistivity instrument, however, it was possible to locate such deposits and to detect hidden contacts between unlike formations such as sandstone and limestone representing planes within which the fluorspar veins were deposited. With this same apparatus buried beds of gravel were also located because their resistivity to the passage of electricity is much greater than is that of soils, clays and other mantles.

Mr. Leighton expressed a desire to hear from Illinois operators with suggestions of problems which the survey might undertake in behalf of industry. He may be addressed at the Illinois Geological Survey, Urbana, Illinois.

New Asbestos Manufacturer to Install Equipment

PROLAC, LTD., formerly the Asbestos Manufacturing Co., Ltd., Lachine, Que., will install new equipment to cost \$100,000, it is reported. The company will manufacture asbestos products, tile, shingle, marble, etc. Jacques Paradis is manager.

Feldspar Gems

THE GROUP OF GEMS included under the general name feldspar occupies only a minor place in jewelry. Feldspars, with the possible exception of quartz, are the most important of rock-forming minerals, but most occurrences are of quite ordinary varieties, without striking color and unattractive. Few specimens are suitable for use as gem stones, but occasional crystals that exhibit unusual brilliance or play of color are cut into various shapes for personal adornment or for architectural decoration.

The best known of the feldspar gems, and probably the most important in point of production, is the moonstone. Amazon stones, labradorite, sunstone, and a number of less common varieties have been produced in various parts of the world.

The feldspars are readily distinguished by their optical properties, moderate hardness, pronounced cleavage, and peculiar color phenomena.

Feldspar occurs as an accessory constituent of all types of rocks; igneous, sedimentary, and metamorphic. Its most common occurrences are in granites, syenites, porphyries, certain sandstones and conglomerates, and in gneisses. Good crystals occur chiefly in pegmatite veins associated usually with quartz, muscovite, etc. Such veins are to be found in regions where granitic rocks abound.

The production of feldspar gems in the United States has always been exceedingly small. Although the mineral itself is widely distributed through many states, feldspar of gem quality has not been mined to a considerable extent, because only exceptionally fine stones are worth more than the cost of cutting.

The several varieties of feldspar are found in the following states: California, Colorado, Maine, New York, Pennsylvania, Virginia, Oregon, Utah, and Arizona.

In addition to the above, information on description of the several varieties of feldspar gems, mining methods, nature of domestic deposits and value of gems is contained in U. S. Bureau of Mines Information Circular 6533.

C. L. Doughman Appointed Chairman of Red Cross Roll Call in Tulsa

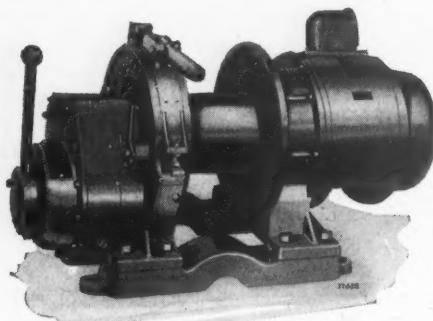
THE APPOINTMENT of C. L. Doughman, Tulsa, Okla., as county chairman for the 50th anniversary Red Cross call for 1931 was announced November 25 by Harry B. Gale, Tulsa county chapter chairman.

Mr. Doughman, representative of the Lehigh Portland Cement Co., is perfecting an organization of leading citizens and workers to carry the personal invitation to join the Red Cross throughout the chapter territory.

New Machinery and Equipment

Electric Portable Hoist

INGERSOLL-RAND CO., New York, N. Y., has added to its line of portable hoists a non-reversible, single-drum electric hoist designed for many applications in the



Hoist has automatic safety drum lock

mining, contracting and industrial fields. It is modeled after the company's "Utility" hoists, except that it uses an electric motor and friction clutch instead of an air motor and a jaw clutch.

The new hoist is suitable for all single-cable work within its capacity such as hoisting timbers, tools and pipe, hauling and spotting cars and for single-line scraping. It is made in two sizes; No. 107 is of 7½-hp. and rated at 2000 lb. pull at 125 ft. per min.; No. 107L is of like power, but has greater drum capacity; No. 110 has a 10-hp. motor and is rated at 2000 lb. pull at 165 ft. per min.; No. 110L has the same power as the No. 110 and the same drum capacity as the No. 107L.

These new hoists are said to be easily operated, to have smooth control and graduation of speed. They have a self-energizing brake for stopping and holding the load and an automatic safety drum lock for added safety when handling suspended loads.

Continuous Filter

THE oscillating continuous filter (Genter type) recently announced by the Bartlett Hayward Co., Baltimore, Md., employs a novel principle. This filter consists essentially of individual tubular elements arranged in squirrel-cage fashion about a central shaft which is open at one end. The cantilever elements forming bars of the squirrel-cage act as filter elements and also as oscillating, agitating arms as they work their way through the sludge bath contained in a tank into which the lower elements are submerged.

A gear-driven mechanism attached to one end of the central shaft oscillates the central shaft and elements in a continuously progressive manner around a complete circle. The speed of oscillation and advance is made to suit the conditions of the material being separated by filtration.

The driving gear may be attached to either end of the central supporting shaft. The cantilever tubular construction makes possible three types of filter design; a single unit, a twin unit and a double unit.

The tubular elements are firmly clamped at one end to a spider containing the filtrate conduits leading to a rotary valve mounted on one end of the central shaft. This valve is said to control the application and cessation of suction automatically on the elements entering submergence and leaving the drying arc, and then permits the application of atmospheric or low-pressure air for cake discharge.

When the cake-coated tubes have progressed in an oscillatory manner to a position directly above the cake conveyor the suction is automatically cut off and successive tubes oscillate past a port admitting either

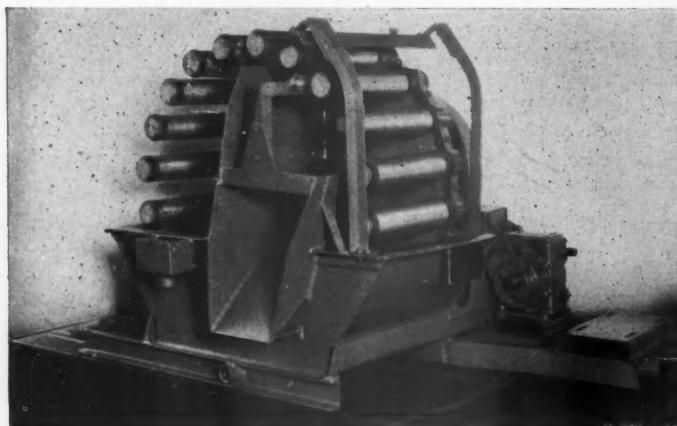
atmospheric or low-pressure air. This loosens the cake on the medium and discharges all or a portion of it into the conveyor. The remainder, if any, is removed immediately thereafter as each successive tube oscillates under one or between two wipers which do not touch the medium.

Among the advantages claimed for this filter are that it operates successfully without the necessity of a recirculating overflow on a dilute feed, a feed containing a wider range of particle sizes, and on all sludges and mixtures now being handled in continuous filters; quicker submergence of an entire filter element; no filter element can pick up a coating of classified fine slimes as it starts filtering; greater drying arc; produces a more uniform cake; produces more cake per square foot area and per unit time of submergence; produces lower moisture in the discharged cake; replacement of any tube is done out of submergence and after the tube has been automatically cleaned of its cake; rotary valve is self-grinding due to the oscillatory movement of the valve plug within the valve body; accessibility to the filter tank and all parts of the filter; and less labor and maintenance costs per ton of discharged solids.

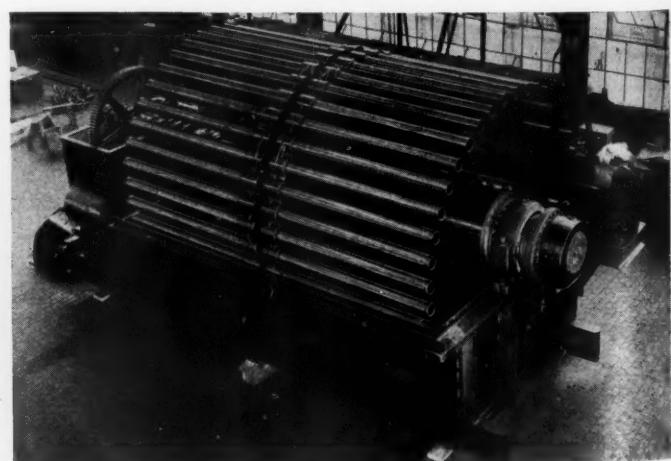
New Type Dryer

THE Louisville Drying Machinery Co., Louisville, Ky., announces its improved dryer, known as the "Type L."

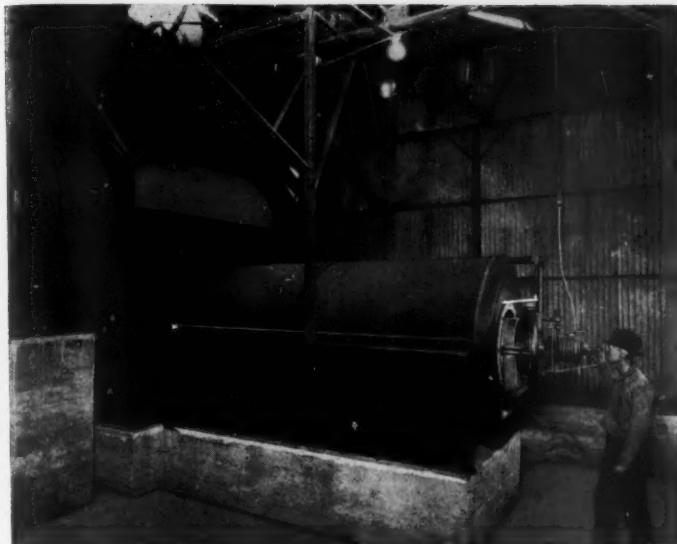
The shell of this dryer is built of heavy steel plates. The feed end of the shell is encased or covered by a casing made either of refractory lined steel or brick work, to heat the feed end of the shell to prevent sticking of adhesive wet material. This casing is provided with



Cake discharge of single unit filter and cake removal details



Twin unit with each series of tubes clamped to common spider



Feed end is encased to heat the feed end of the shell

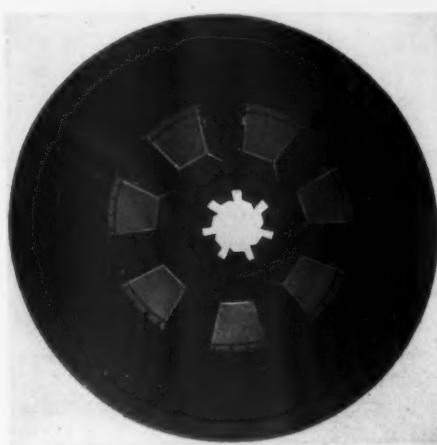
Louisville metal-to-metal self-adjusting air seals for the prevention of leakage at the revolving joints, and is a part of the fuel burning furnace.

The shell, where it is covered by the casing, is perforated with a series of openings, to each of which is anchored the inlet of a small conduit of special cross section, fastened to the inner side of the shell. The conduits are anchored at the gas inlet end and are supported against the shell by means which allow for free longitudinal expansion but at the same time, prevent radial play, the manufacturer states. Air spaces are provided between the bottoms of the conduits and the shell to minimize radiation losses. The flights which lift the material and shower the same, are attached as lips to the conduits.

According to the manufacturer, the hot gases pass through the conduits, leaving from their open ends near the dry end of the dryer, and then returning in the free open space in the center of the shell, back to the feed end hood, whence they are exhausted by a fan.

The feed end of the dryer, to which is

return gases must do their quota of work; the material comes in contact for longer periods with heated surfaces; the feed end of the dryer is unobstructed, and the feed



Flights lift and shower material

end where the wet sticky materials are fed is heated.

These advantages are said to result in more efficient use of fuel, greater capacity, ease of handling and low maintenance.



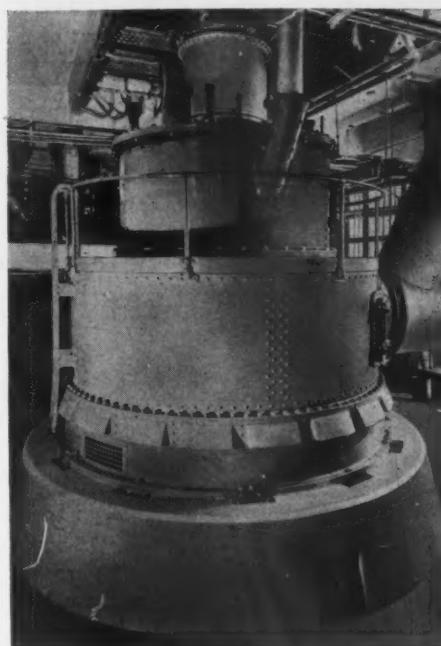
The shell is perforated with openings to which small conduits are anchored

connected a steel hood or throat piece with helical conveyor or chute, is unobstructed so that any size feed device may be used. The discharge of the dried material is made either through a steel hood at the dry end or by means of an axial outlet, as selected.

Advantages claimed for the "Type L" construction are that it eliminates structural difficulties since there is no wear on the conduit suspension; there is no dead space and all of the

High Capacity Coal Pulverizer

A RECORD for coal pulverizers was recently established when the Fuller Lehigh Type B mill shown in the accompanying view pulverized 50 tons of coal per hour at



Pulverizer at Kips Bay Station

the Kips Bay Station of the New York Steam Corp., New York City.

The mill is driven by a direct-connected 500-hp. vertical synchronous motor and occupies a floor space of only 14 ft. 6 in. in diameter.

Code Wire Has Colored Rubber Insulation

A METHOD of identifying its various grades of code wire by means of colored rubber insulation has been adopted by the General Electric Co., Schenectady, N. Y. Thus users may have the assurance that installations are up to specifications without the need for complicated and expensive laboratory tests.

By means of this marking the grades of wire in an installation may be identified at any time for years after the wiring system is in use.

The three grades will be marked with colored rubber insulation as follows: code—black; intermediate—red; 30%—green. Another feature is tighter and closer braids with an improved weatherproof finish.

Erratum

IN THE DESCRIPTION of the constant weight feeder manufactured by the Hardinge Co., York, Penn., which was given on page 84 of ROCK PRODUCTS, November 21, capacities were incorrectly stated. The correct capacities range from 20 lb. to 650 tons per hr.

Balanced Hoist for Stripping Shovel

A NEW feature in shovel design is the balanced hoist for stripping shovels announced by the Bucyrus-Erie Co., South Milwaukee, Wis.

This new hoist increases the output of the stripping shovel by increasing the dipper size and by increasing the operating speed of the shovel, the manufacturer states. Its essential parts are a movable counterweight with the necessary guides and tackle, so arranged that as the dipper goes up through the bank in its digging motion the movable counterweight travels downward in its guides, counterbalancing the weight of the dipper and increasing the amount of digging force available.

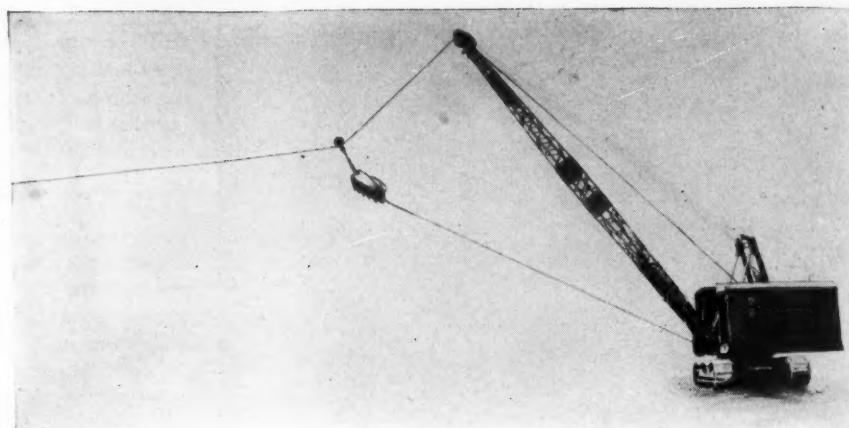
As the dipper is returned to the pit for the beginning of its next cycle, the counterweight is raised in its guides so that it is again ready to counterbalance the dipper. Thus, during the hoisting cycle practically all power of the hoist motors is spent in actual digging, it is said.

Advantages claimed for this hoist are: increased digging power, both speed and digging force, without the use of larger electrical equipment; faster acceleration of the dipper in both digging and returning to the pit; more accurate handling of the dipper; less heating of hoist motors and generators—lower average current and longer life; and reduction of peak loads and consequent reduction in the current figure registered by demand meter.

The counterbalanced hoist is claimed to make possible the use of much larger dippers without any increase in the size of electrical equipment and without any appreciable increase in the total weight of the machine beyond increased weight of the dipper and dipper contents.



Counterweight speeds shovel operation



Scraper bucket rigged up with crawler dragline with special carrier, increasing reach to 300 ft.

Substitutes Crane Boom for Drag Scraper Tower

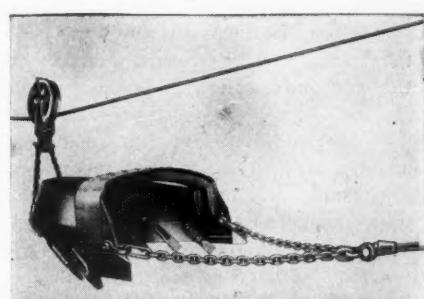
A RECENT DEVELOPMENT in excavating practice is described by Sauerman Bros., Inc., Chicago, Ill., and centers around the use of a crane or revolving dragline to operate a Sauerman "Crescent" scraper bucket for stripping overburden and moving materials from rivers and pits. The combination of drag scraper and boom machine is adaptable as a substitute for a tower excavator when the yardage to be handled is not large enough to justify investment in the latter type of machine and for distances up to 300 ft.

One of the accompanying illustrations shows a Crescent bucket attached to a special type of carrier designed by Sauerman engineers, and the other illustration shows this same bucket rigged up with a standard revolving dragline, practically converting this machine into a 300-ft. span tower excavator.

It is said to be relatively easy to rig up any type or make of boom machine for this

method of operation. Most cranes and draglines can be converted to drag scraper operation without mechanical alterations other than the placing of suitable lagging on the drums. Occasionally it is desirable to provide an outboard support or guy cable for the boom when the digging is particularly difficult.

The regular drag cable is replaced with a longer cable which attaches to the front



Bucket and carrier for use with crane or boom dragline

chains of the scraper bucket. The regular hoist cable also is replaced with a longer cable, which leads over the sheave at the end of the boom and out to a movable tail anchorage. This latter cable serves as an inclined trackline for the carrier and bucket.

The boom generally is held at its maximum elevation during the entire operation. The trackline is slackened off while the bucket is digging and bringing in a load, but when the bucket arrives at the dumping point, the operator pulls this cable taut by a few revolutions of one drum, thereby raising the bucket into the air. As the bucket is bottomless, it deposits its load automatically when it is lifted. Then the load cable is allowed to unwind from the other drum, and the carrier, impelled by gravity, carries the empty bucket back down the inclined track cable to the place of excavation.

In equipping a boom machine with a scraper bucket, it generally is practicable to use a bucket of a cubic capacity substantially larger than the standard dragline bucket for which the machine is rated.

Sound Insulative Machine Base

A MACHINE BASE designed to reduce the sound and vibration transmitted by machinery through its base is announced by the United States Gypsum Co., Chicago, Ill.

The construction is essentially that of a rigid platform supported on sensitive resilient steel springs, which form the only continuous connection with the floor. These springs are said to absorb the vibrations so that practically none are carried into the frame of the building.

Each base is individually designed and manufactured for the piece of equipment or machinery it is to carry. The arrangement, number, and size of the resilient steel springs is determined by such characteristics of the machine as, its weight

with either a concrete or a steel platform, depending upon the type of machine or equipment it is to support. A wooden platform may also be furnished if desired.

There are many applications about rock products plants where vibration of the equipment affects the length of life of both plant and equipment. Motors and



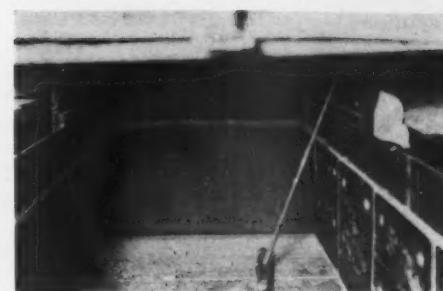
Entire load is supported by springs

fans in dust collecting systems are particular applications where this type of base might prove of value.

Apron Feeder

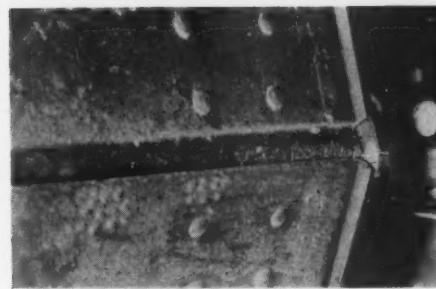
IN THOSE CASES where a uniform flow or discharge to a crusher is required but is difficult to obtain some form of automatic feeder is desirable. The apron, or pan feeder as developed by the American Manganese Steel Co., Chicago Heights, Ill., is said to be suitable for this work.

This Amsco feeder is said to be made entirely of manganese steel. Features of the design claimed by the manufacturer are (1) the smooth apron surface with floor and side flange overlap, said to prevent fouling, leakage and spillage; (2) one-piece chain lengths, and knee type joints, said to prevent sag between supporting track wheels; (3) no rollers in the chain; (4) no lubrication of chain parts is



Smooth conveying surface is provided

said to be needed; and (5) no operating attention except lubrication of shaft bearings is required; (6) no chain wear except when rounding drive sprocket and (7) no floor shovel cleaning of leaks and spills.



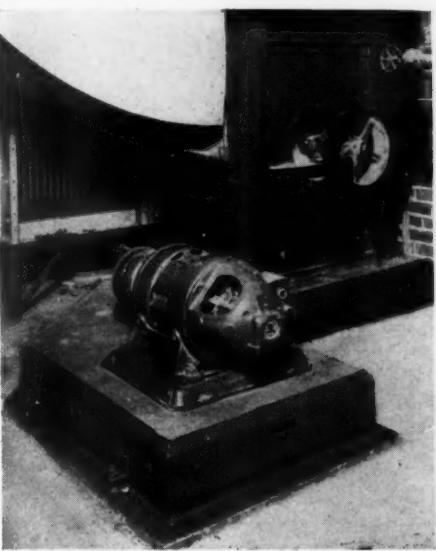
Floor and side flange overlap to prevent leakage

Amsco feeders are made in sizes from 2 ft. to 8½ ft. wide. The manganese parts are furnished by the American Manganese Steel Co. and complete installations of the feed-



One-piece chain lengths in top run of feeder have knee type joints

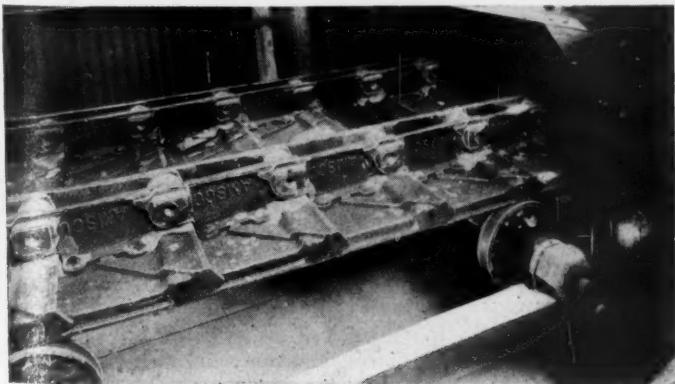
ers are engineered and furnished by the Stephens-Adamson Manufacturing Company, Aurora, Ill.



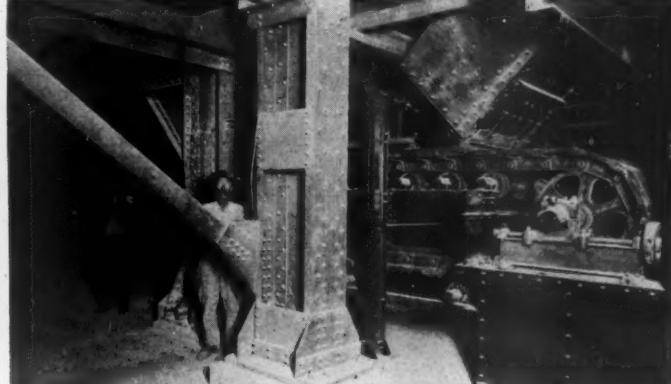
Either steel or concrete platform is optional

and distribution, the speed, magnitude of vibration, etc. The manufacturer states that each spring is loaded to the point of maximum efficiency, considering the proper factor of safety. Supplementing the action of the resilient steel springs is Thermofill, a dry material said to be both fireproof and sound absorbent.

The standard base is made of steel



Return run showing rigidity between supporting wheels



Receiving end of apron feeder

Gypsum in 1931

THE FOLLOWING TABLE shows the result of a canvass by the United States Bureau of Mines, Department of Commerce, of the gypsum industry to show the quarterly production, imports, and sales of gypsum and gypsum products in the United States:

QUARTERLY PRODUCTION, IMPORTS AND SALES OF GYPSUM AND GYPSUM PRODUCTS IN THE UNITED STATES IN 1931, AS REPORTED BY OPERATORS

	First quarter	Second quarter	Third quarter
Number of operators reporting.....	33	35	34
Crude gypsum mined.....	545,018	851,082	640,068
Crude gypsum imported (as reported by importers).....	(*)	156,448	303,784
Crude gypsum sold (domestic and imported).....	126,543	262,841	234,938
Calcinized gypsum produced from domestic and imported rock.....	444,116	578,621	493,552
Calcinized gypsum products sold from domestic and imported rock:			
For pottery, terra cotta, plate glass, mixing plants, etc.....	54,921	51,993	44,010
Keene's cement.....	7,894	7,658	6,990
Neat, wood fiber, sanded, gaging, finished plasters, etc.....	302,237	410,942	373,808
Wall board.....	88,569,846	105,129,361	72,122,523
Plaster board and lath.....	53,873,521	65,925,953	56,525,903
Partition tile.....	6,052,441	7,016,019	5,315,636
Roof tile.....	(*)	(*)	(*)
Other tile.....	(*)	(*)	(*)
Other calcined gypsum sold.....	3,427	3,376	3,313
"Less than three operators reporting.....			

Operators whose figures are included in the statement for the third quarter in the above table:

American Gypsum Co.
Arizona Gypsum Plaster Co.
Atlantic Gypsum Products Co.
Atlas Gypsum Products Corp.
Beaver Products Co. of Virginia, Inc.
Best Bros. Keene's Cement Co.
Blue Diamond Corp.
Cardiff Gypsum Plaster Co.
Certain-teed Products Corp.
Colorado Portland Cement Co.
Connecticut Adamant Plaster Co.
Ebsary Gypsum Co.
Grand Rapids Plaster Co.
Gulf Gypsum Co.
Jumbo Plaster and Cement Co.
Hawkeye Gypsum Products Co.
Lycoming Calcining Co.
Michigan Gypsum Co.
National Gypsum Co.
Newark Plaster Co.
Oakfield Gypsum Products Corp.
Pacific Portland Cement Co.
Paoli Gypsum Mine, A. P. Shepard.
Phoenix Gypsum Co., Inc.
Chas. W. Priddy and Co., Inc.
Regan Bros.
Rutland Fire Clay Co.
Standard Gypsum Co.
Texas Cement Plaster Co.
Three Forks Portland Cement Co.
Universal Gypsum and Lime Co.
United States Gypsum Co.
Victor Plaster, Inc.
Wasem Plaster Co.

Stones from Various States for an Arch

CANON CITY, Colo., decided to erect a stone arch at the approach to its "Sky-Line Drive," which leads to the top of the Royal Gorge.

Governors of all the states were informed and advised that the arch would be known as "Gateway of the States," to please send a stone suited for the structure. The response was prompt and generous. Vermont sent granite slabs; Minnesota, granite; California, gold-bearing rocks; New Mexico, copper-bearing rocks; Montana, flathead quartzite; Idaho, volcanic bomb; Iowa, flint ball from its Doud's quarry; Michigan, kidney limonite; North Carolina, Texas and Rhode Island, granite; Utah, many pieces of commercial minerals; Arkansas, a variety of 13 stones; Virginia, 17 pieces, among the lot limestone and soapstone; Missouri, a decom-

posed stalactite taken from an old cave; Pennsylvania, black granite and fossiliferous sandstone; Florida sent 18 species of porous rock; Maine sent the most beautiful thus far. The rocks have the appearance of jewels, rose quartz, green beryl and watermelon tourmaline of varied hues.

Recent Prices Bid and Contracts Awarded

Tiro, Ohio. Recently the county line road surfacing between Crawford and Seneca counties was contracted and the successful bidder agreed to place the stone on the road at a cost of 78c. per ton. The road is ten miles long. The stone will be hauled from the Bloomville quarries direct to the road by truck.

Winterset, Ia. Madison county supervisors divided the contract for surfacing 4½ miles of county road between Ray Estel and the Winterset Limestone Co., two bidders. Each gets half of the contract for placing 4,700 cu. yd. of crushed rock. The price to be paid for the crushed stone delivered on the road is \$1.40 a cu. yd. The contractors do not spread the stone.

Joliet, Ill. The city is paying \$1.65 a cu. yd. for stone delivered for street repairs. It was stated that the price at the quarry was \$1.25 but that 40c. a yard was paid for hauling.

Milwaukee, Wis. Opening of bids on the city's 1932 cement supply revealed a drop of 33 c. per bbl. below 1931 figures. Schneider Fuel and Supply Co. was low, with a net price per barrel, after deducting a 40 c. sack return refund, of \$1.15 for the 20,000 bbl.

Plans for Gypsum Plant in California Progress

DURING the past three months T. T. Langlois and the Westmorland Chamber of Commerce have been negotiating with Messrs. Cubberly and Sternberg, owners of gypsum deposits west of Westmorland, Calif., relative to securing a site for a gypsum plant there.

Tentative arrangements have been made for the leasing of land in Westmorland so that sheds can be built for the shipping of the product. Arrangements are being made to secure further land upon which to build the plant.

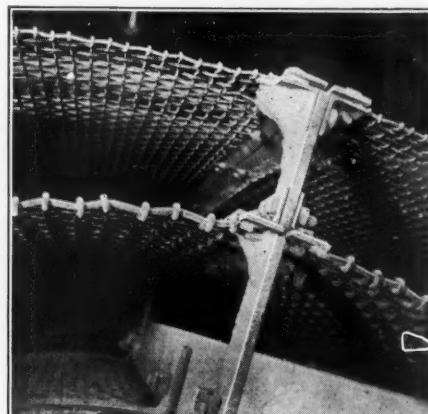
Delay in getting started on the project was due to freight rates which have been met.

The building of this plant in Westmorland means an additional payroll, as the raw material is going to be trucked from the mines to Westmorland and prepared for shipment to coast and eastern markets.

The plant will be small at first, but as the business grows other units will be added.—*Westmorland (Calif.) Mail*.

Screen Installation Five Years Old

THE Ludlow-Saylor Wire Co., St. Louis, Mo., is re-distributing a booklet printed in 1927, containing an illustration of its first installation of "Spring-Steel" woven wire screens, which were placed in service in July of 1926.



This screen has served five years

Grows Mushrooms in Quarry

THE Auxvassie, Mo., quarry, besides yielding crushed rock, is now producing

mushrooms. They are grown in a cavern 100 ft. underground.—*Mid-West Review*.

Book on Belt Drives

THE NINTH EDITION of Rhoads Belt User's Book has been issued by J. E. Rhoads and Sons, Philadelphia, Penn. The specific suggestions, rules, tables and charts contained in previous editions have been retained in this issue. Brief discussion of short-center drives and group and individual drives have been added.

The accompanying illustration shows a portion of two concentric revolving-screen jackets made of "Spring-Steel" wire, which to date are said to have given more than five years of service on a 24-ft. cylindrical scalping screen. The feed is Illinois limestone, and at peak load the crusher delivers 400 tons per hour to the scalping unit.

News of All the Industry

Incorporations

Kingsland Granite Co., Llano, Tex., \$35,000. W. H. Johnson.

Pacific Coast Silica Co., Ltd., San Francisco, Calif. Andrew Eggum, Herbert W. Erskine and J. Benton Tully of San Francisco.

Indian Hill Stone Co., Indianapolis, Ind., a Delaware corporation, amended charter increasing the capital stock to 5000 shares of no par value.

Ash Grove Lime and Portland Cement Co. of Texas, Dallas, Tex., \$10,000. L. T. Sunderland, A. B. Sunderland and W. P. Sabin.

Floyd Million & Son, Inc., Lake Cicott, Ind., 500 shares of \$100 each. Floyd Million, Jennie Million and W. F. Million. To operate sand and gravel pits.

Cook and Nichol, Inc., Memphis, Tenn., \$10,000. W. L. Nichol, Jr., president, and S. L. Cook, vice-president. To deal in lime, cement, roofing and other building materials.

Colprovia Road Products, Inc., Columbia, S. C., \$20,000. G. D. Lott, president; V. D. Lott, secretary and treasurer, and S. C. Dreyfus, director. To produce road building material.

Atlas Olympia Co. of California, Santa Cruz, Calif., 5000 shares common of no par value. A. K. Humphries, Alameda, Calif., and R. G. Frith and A. S. Glikbarg, San Francisco, Calif. To produce sand and gravel.

Magnesium Properties Co., San Francisco, Calif., \$15,000. Henry W. Zillmer, Grace A. Whittaker, Peter Sanguineti and Giulio Zarri, all of San Francisco. To produce chemical products and minerals.

Worth Milling Co., Inc., Middletown, Conn., \$150,000, consisting of 1500 shares, par value \$100 each. Robert A. Van Voorhis, Belleville, N. Y., R. H. Toothe, Brooklyn, N. Y., and A. M. Dicken, Woodside, N. Y. To produce and deal in sand, gravel, etc.

Mississippi Portland Cement Co., Starkville, Miss., \$1,500,000. Andrew Fitzpatrick, New Orleans, president; J. M. Evans, Jackson, Miss., vice-president; Frank J. Duffey, Natchez, Miss., secretary-treasurer; W. W. Magruder, Starkville, general counsel, and George B. Hightower, Starkville, fiscal agent.

Quarries

Texas Quarries Co., Llano, Tex., is now operating its new plant near Kingsland.

Alcoa Quarries, Maryville, Tenn., has recently installed equipment to produce agricultural limestone.

Limestone Co., Seattle, Wash., has applied for an amendment changing its place of business to Vancouver, Wash.

France Stone Co. quarry, near Bloomville, Ohio, it is reported, is working day and night shifts of 10 hours each.

Whitehouse Stone Co., Whitehouse, Ohio, is featured in a recent article in the *Toledo Blade*. Its operations for over 50 years were described.

Auxvasse Quarry, near Fulton, Mo., has started work on a 15,000-ton contract for state highway work. A ventilating system is being installed in the quarry mine.

Hoffman Brothers and Wilson, Harrisburg, Penn., report that rush orders have almost completely exhausted its storage and that it anticipates a heavy demand the rest of the year.

Tidewater Stone and Supply Co., Hackensack, N. J., was recently described in a local newspaper. Both its ready mix concrete and crushed stone operations were featured in the story.

Macedonia, Ia. After more than 45 years of inactivity the rock quarry north of here will be opened by the state highway commission, it is reported.

Greer Limestone Co., Morgantown, W. Va., was recently featured in the rotogravure section of the *Morgantown Post*. The story was built around the use of its product in state highway work.

Jesse Johnson, Pleasant Hill, Mo., has offered rock from his quarry at 10c per ton to relieve local unemployment. The city will operate the quarry, paying \$1.50 a day to labor.

Rigaud (Que.) Granite Products, Ltd., is being liquidated. Reports state the liquidator has sold the assets, but due to the heavy costs and privi-

leged claims there will be no dividend to the ordinary creditors.

M. A. Gammino Construction Co., Providence, R. I., is moving its crushing equipment from Jewett City, Conn., to Brooklyn. It will start operation there at once to supply stone for a state road contract.

Van Wagner Construction Co., Mt. Gilead, Ohio, one of the largest road-building companies in that section, is to sell its entire machinery and equipment at public auction December 3 by order of the U. S. District Court of Ohio.

Messrs. Pete Matson and Cecil Deering have leased the granite quarry of Willis Meyer near Lakeside, Calif., and will operate the quarries. The lessees are said to have advantageous contracts for the silver gray granite produced in this quarry.

Ouachita Quarries, Little Rock, Ark., is reported to have secured over 1500 acres of stone properties in Montgomery county. The company plans installation of quarrying and conveying and other equipment. E. B. Bird, Little Rock, Ark., is engineer.

Inland Lime and Stone Co., Manistique, Mich., is cooperating with the Northwestern Cooperage and Lumber Co. and the Michigan state highway department in taking over a mile of timber 20 ft. wide on each side of the highway near Antigo, Wis., for permanent preservation.

Sand and Gravel

Bastrop, Tex. Gravel pits and sand beds on the Colorado river are being developed near here.

Garden City Sand Co., Chicago, Ill., is reported to have filed a voluntary petition in bankruptcy.

Marysville, Kan. A gravel plant has been set up near Hull and is now operating. This will supply granite for road district 14 near Marysville.

Kirkpatrick Sand and Cement Co., Wetumpka, Ala., and its foundry sand holdings will be sold at public auction December 21.

Cassopolis, Mich. Cass county road commission is contemplating purchase of a 40-acre gravel pit from Mrs. C. A. Breece for \$2,000.

Mercer-Fraser Co. has moved its gravel plant to Eureka, Calif., from the Rogue river bridge job where it was in operation.

Sybolt Sand and Gravel Co., Marion, Ind., will not be placed in receivership, the circuit court has ruled. Application for receiver had been filed by Arthur A. Davis, of Indianapolis.

M. B. Musgrove, Logan, Ia., has leased his sand pit south of Woodbine to the Kregre Construction Co. who is operating day and night shifts at the pit.

Columbia Sand and Gravel Co., Hamilton, Ohio, is now operating under Gordon Reed as receiver. Appointment of Luther Robinson has been rescinded.

McClain Sand Co., Morgantown, W. Va., is featured in the rotogravure section of a recent issue of the *Morgantown Post*. Illustrations of buildings on which it had supplied material were shown.

Universal Sand Co., Newcastle, Penn., is defendant in a suit to bring action of ejectment to clear title to land which has been under lease by the sand company. Because the sand company had failed to open up the sand it was claimed the lease was invalid.

Richmond Sand and Gravel Corp., Richmond, Va., recently was given a publicity story in the *Richmond Times-Dispatch*. Its rapid advance in business since it was founded five years ago, being now one of the largest concerns of this kind in the state, is credited as evidence of its efficient service.

Springfield, Ore. Application for permit to dredge gravel from the Willamette river near Springfield has been made to the district engineer of the War Department at Portland. Investigation of complaint that residue from gravel screening operations was likely to change the main course of the river has been started by Lane county court.

Topeka, Kan. Curtailment in construction of sand roads by the state highway commission has already been a hard blow to sand companies operating along the Kaw and Arkansas rivers. One sand company with 12 plants on these rivers is operating three on reduced schedules and has closed nine. Other companies report about the same condition.

Spokane, Wash. H. W. Bashore, engineer of reclamation bureau, announces that five sand and gravel testing pits along the Columbia river near the Grand Coulee have been opened to determine

the quality and amount of sand and gravel available for the construction of the Columbia Basin dam.

Cement

Wellston Iron Furnace Co. announces removal of its general offices from Jackson, Ohio, to Portsmouth.

Fort Scott Hydraulic Cement Co., Fort Scott, Kan., will take bids soon for rebuilding its mill recently destroyed by fire.

Lehigh Portland Cement Co. has announced its Iola plant will continue operation until about January 1.

Marquette Cement Manufacturing Co., Chicago, Ill., reports October shipments were 25% greater than the same month in 1930.

California Portland Cement Co., Los Angeles, Calif., has resumed operation of its lime plant at Colton which has been closed since late in July.

Lone Star Cement Co., Alabama, has contributed \$1697 to the Birmingham county chest fund, against \$792 last year.

Stockholm, Sweden. Shanska Cementaktiebolaget, the largest cement manufacturer in Sweden, recently opened a new plant with an estimated annual output of 500,000 bbl.

Missouri Portland Cement Co. employees at its Independence, Mo., plant contributed practically 100% to the Civic Relief Fund, officials have announced.

Olympic Portland Cement Co., Bellingham, Wash., was recently featured in *Puget Soundings*, a feature column in the *Bellingham Morning Herald*. A description of its plant and processes was continued for a number of issues.

Cemento Portland Nacional, S. A., Hermosillo, Mex., has started operations at its new plant. It is reported many advance orders have been received for the product. Ignacio Soto will take an important part in the operation of the new concern.

Hawkeye Portland Cement Co., Des Moines, Ia., is suing for \$40,873 alleged to be due for cement used in construction of a road near Ames. The contract was originally awarded the McLaughlin Construction Co. but was assigned and the work done by the Larson, or Highway Construction Co. of Des Moines.

Lawrence Portland Cement Co. is conducting a special campaign in November at its Thomaston, Me., main plant to continue the safe operations there. It has gone through the first 10 months of 1931 without an accident. Shipments in September from this plant were the largest of any month in the year.

Lime

Valley Lime and Power Co., McMillin, Wash., has installed new machinery and is now operating an air separated product. Agricultural lime and chicken grits will also be produced and it is reported that both are enjoying an increased demand. A group of Seattle men, it is reported, have purchased the plant. L. C. Healy has been appointed sales manager.

Cement Products

William Todd, Point Pleasant, N. J., suffered \$1800 damage at his cement block plant recently.

Tobe See has been appointed office manager of the Cement Products Co. at Renton, Wash.

Universal Cement Pipe Co. has made rapid progress in the construction of its concrete pipe plant at Sandusky, Ohio. It is reported the plant will have a capacity of from 75 to 100 tons of concrete pipe per day. It is planned to have this plant in operation about January 1.

Herman E. Meier, secretary and manager of the Northwest Davenport Cement Block Co., has been chosen chef de gare of the Davenport voiture of the Forty and Eight society, fun organization composed of men selected for distinctive service to the American Legion.

Hydro-Stone Co., Memphis, Tenn., suffered considerable damage in a fire in its plant there, November 19. Cast-stone trimming being completed for the U. S. Engineers Building was badly damaged and will have to be replaced.

Concrete Corp., Milwaukee, Wis., reports October, 1931, as bringing the largest amount of orders

of any month since October, 1929. Shipments likewise were near a two-year record, last month's total being exceeded only slightly by June, 1930, L. E. Pitner, vice-president.

Carbon Concrete Brick Co., Youngstown, Ohio, has had its products featured in a news story in a recent issue of the *Youngstown Telegram*. The high quality of the product and control in manufacture was described. This is a subsidiary of the Carbon Limestone Co.

H. B. Deatherage, Louisville, Ky., is operating the plant formerly operated by the Jackson Concrete Products Co. He is making hand-wrought mantles of individual design and reports that business is good. Beside mantles, Mr. Deatherage also produces concrete garden furniture, window sills, coping and other products.

Gypsum

United States Gypsum Co. recently was host to the Fort Dodge, Ia., Rotary Club at its plant there. F. J. Reinking, works manager, conducted the club through the plant, describing the processing of various products. It is still using an 8-hour shift, running 24 hours a day, and by dividing up the time very few men are reported to have been laid off.

Montreal, Canada. A record for loading at Port Windsor was made November 9 when two steamships took 6700 tons of crude rock for United States ports, both being loaded in one day. Formerly it took four days to load at Windsor. New machinery installed by the Canadian Gypsum Co. Ltd. is said to make the new loading schedule possible.

Miscellaneous Rock Products

Holdenville Marble Works, Holdenville, Okla., has been purchased by T. J. Prothro, former owner.

Cordele Marble Works, Cordele, Ga., has started repairing its plant, which was recently damaged by fire.

McSwain Glass Co. has purchased the old Van Buren glass plant at Van Buren, Ark., and a general line of glass products will be made.

Stauffer Chemical Co. announces the construction of a new building in Los Angeles, Calif., to be used for the production of acid super-phosphates.

Richard W. Smith, assistant state geologist, will make a survey of mica and feldspar deposits in Lamar, Ga.

Leningrad, Russia. Deposits of diatomaceous earth estimated at about 300,000 tons were recently discovered near the Devil's Swamp near Kingisep.

Magnesium Properties Co., Laramie, Wyo., has filed articles of co-partnership and plans extensive development work near Rock river.

Phosphate and Chemical Co., Portland, Ore., will soon open a phosphate mine in Montana, Alan Swain, president, reports.

Hopkins, N. C. A Mr. Reece and a Mr. McNeill of Tennessee have taken lease on lands of Messrs. L. M. Cheek and J. D. Church here and are prospecting for kaolin and feldspar deposits.

Texas-Gulf Sulphur Co., New York, N. Y., advises no construction is in view in connection with the acquisition of sulphur rights on large acreage in Jefferson county, Tex.

Consolidated Feldspar Corp., Kingman, Ariz., has completed its new plant there and expects to start operations soon. Both silica and feldspar will be ground in the new plant.

Sylva, N. C. Several carloads of olivene have recently been shipped from here. It is also reported that J. K. Kenney will soon build a mill to grind mica.

Tennessee Quartzite Co., Crossville, Tenn., through its receiver has granted to E. Rhode, president of the company, authority to continue operations at its quarries.

Tri-State Tripoli Co., Miami, Okla., has completed a plant at Kansas City, Mo., to mill crude tripoli. It is reported to have a 3-year contract to supply 50 tons of tripoli daily to the American Asphalt Co.

Vang Crushed Stone and Amiesite Corp., Casper, Penn., is said to plan enlargement of its operations there. It was recently host to an inspection party of road officials who were conducted through the plant by H. R. Eicher, district sales manager.

Elmer and Alma Edgar have applied for a mining lease in Granite county, Mont. They report more than a million tons of granite available near Hall and that assays on the ore are high. When granted a lease they plan to install a crusher and other equipment.

Union Salt Co., Cleveland, Ohio, and its operations were recently featured in the *Cleveland*. An interesting story describing the history and telling of the development and the extent of the salt industry in Ohio and other sections of the United States was given.

Rock Products

W. E. Prosser, Sandersville, Ga., has sold 160 acres of kaolin land to Philip Weltner of Atlanta. Kaolin is now being hauled there for shipment by the American Industrial Clays, Inc., from its operation. It was recently reported that a tram railroad may be built to the clay deposits about 11 miles west of Sandersville.

Dallas, Tex. Tests by the government of potash deposits in western Texas and southwestern New Mexico have been made. Drilling started in November by the Sullivan Machinery Co. of Chicago for the U. S. Geological Survey and the U. S. Bureau of Mines. The completion of this well will conclude a program of five-year potash exploration activities of the government.

Montreal, Can. Canada's supply of granite rock suitable and desirable for building purposes has been enriched by the discovery of a large deposit of red granite at Collins Inlet on the north shore of Georgian Bay, in Ontario. The deposit, which it is understood has been visited by quarrymen with a view to development, was reported to Dr. W. H. Collins, director of the geological survey, Department of Mines, by Dr. T. T. Quirke, who has been surveying the district.

Personals

Elmer Hayes has been appointed superintendent of the Phoenix Sand and Gravel Co., Belton, Tex.

Edward Merriam Dutcher, vice-president and director of the Limestone Products Corp. of America of Newton, N. J., resigned November 11.

E. P. Newhard has been appointed superintendent of the Clinchfield, Tenn., plant of the Pennsylvania-Dixie Cement Corp. He succeeds C. S. Vance.

Frank A. Martin, formerly with the California Portland Cement Co., Colton, Calif., has severed his connections with that company and returned to Chicago, Ill.

H. W. Haapanen has been appointed district representative in West Virginia mining territory by the Webster and Weller Manufacturing Co., Chicago, Ill. Mr. Haapanen is a mining engineer widely known in the coal mining field and is a member of the A. I. M. E.

Albert W. King has resigned as service manager of the Cowham Engineering Co., Chicago. Prior to his connection with the Cowham company, Mr. King was in the Structural and Technical Bureau of the Portland Cement Association. He also spent 10 years in charge of the Materials Testing Laboratory of Science, Manila, Philippine Islands, during which period he was appointed professor of civil engineering in the College of Engineering, University of the Philippines. He has also been associated with the Kalman Floor Co. and the Atlas Lumnite Cement Co.

Homer Handley, engineer of the Portland Cement Association of Seattle, Wash., addressed the Associated Engineers of Spokane at a luncheon recently on the "Trend and Development of Cement." He also addressed the American Society of Civil Engineers at Seattle on "Monolithic Concrete in Building."



H. W. Haapanen

Obituaries

O. S. Petersen, for several years connected with the Security Sand and Gravel Co., of Janesville, Wis., died recently in Chicago.

Joseph McCormick, 75, died at his home in Seekonk, R. I., November 20. He has operated quarries in North Providence and East Providence and has been engaged in the sand and gravel business as well, in addition to other business interests.

Manufacturers

Neille La Vieille Supply Co., Louisville, Ky., has been appointed local representative for Foote Bros. line of IXL gears and speed reducers.

Morris Machine Works announces the new location of its Detroit office as room 901 New Center Building.

Four Wheel Drive Auto Co., Clintonville, Wis., announces F. C. Miller has rejoined its organization as a member of the sales engineering staff.

Four Wheel Drive Auto Co., Clintonville, Wis., announces it has added another shift to take care of the increased demand for FWD trucks.

Blaw-Knox Co., Pittsburgh, Penn., announces

it will display various road equipment in space 119 at the Road Show in Detroit in January.

Jaite Co., Jaite, Ohio, manufacturers of large heavy duty paper bags, has purchased a tract of land in Los Angeles county and is constructing a factory to supply the western states territory.

Firestone Tire and Rubber Co. announced recently it would construct a battery manufacturing plant costing approximately \$100,000, to produce 1200 batteries a day at Los Angeles, Calif.

Sheffield Steel Corp. announces the election of R. L. Gray as president. Mr. Gray graduated from Washington University in 1916 and has been active in the steel industry since that time.

Foote Bros. Gear and Machine Co., Chicago, Ill., announces the appointment of L. W. Erickson as district representative in charge of a new district office that has opened in Milwaukee.

Hercules Powder Co., publishers of the *Explosives Engineer*, announces "Drilling and Blasting in American Metal Mines," a book it published, has been reprinted in Russian and is to be used for technical instruction in the U. S. S. R.

Ev-Air-Tight Calking Co., New York, N. Y., recently completed a contract for calking the Empire State Building. Approximately 6000 ft. of Titan air hose, made by the Diamond Rubber Co., was used in executing this contract.

Truscon Steel Co., Youngstown, Ohio, has taken over the building products division of the Berger Manufacturing Co., Canton, Ohio, and will continue to operate it as the Berger Building Products Division of the Truscon company.

Armclo Distributors' Association will meet in Middletown, Ohio, December 9 and 10. Bruce Barton, editor and advertising man, and Charles R. Hook, president of the American Rolling Mill Co., will address them during the convention.

Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., was recently designated as having one of the nation's best Industrial Relations programs and was presented an award in a contest conducted by B. C. Forbes. The program was described in detail in a recent issue of *Forbes* magazine.

Grindle Fuel Equipment Co., a subsidiary of Whiting Corp., Harvey, Ill., has been absorbed by the parent company and will be operated as a separate department under the name of "Pulverizing and Combustion Equipment Division." W. R. Bean, former president of the Grindle Fuel Equipment Corp., has been made a vice-president of Whiting Corp. in charge of the newly formed division.

Beckwith Machinery Co., Pittsburgh, Penn., has added the Byers line of shovels and cranes to its line of equipment. Its territory will include western Pennsylvania, southeastern Ohio and counties in West Virginia within 100 miles of Pittsburgh. Repair parts stock and service men will be available 24 hours a day and seven days a week. A 1/2-cu. yd. Byers shovel is now on display at its Pittsburgh display room.

Kentucky Wagon Manufacturing Co., Louisville, Ky., announces its business has been improving and that it has been in continuous operation. A claim of the National Bank of Kentucky and the Banco-Kentucky Company against the company for \$27,700 has been held invalid by Judge Dawson on the grounds that these companies bought the wagon works as an investment and the amount was not a loan as claimed.

Worthington Pump and Machinery Co., Harrison, N. J., announces the appointment of G. B. Cumming as manager of sales of the resale and meter division; C. E. Oechsle, manager of the contractors' division; C. A. Hirschberg, manager of the rock drill and sales service; E. E. Hoffman as assistant manager of the New York sales staff; E. S. Hiley and E. C. Stewart in the rock drill division; and J. J. Summersby, Jr., assistant general sales manager in charge of resale activities. Thomas Cruthers will continue as assistant general sales manager in charge of industrials, the position which he has held since January, 1930.

Trade Literature

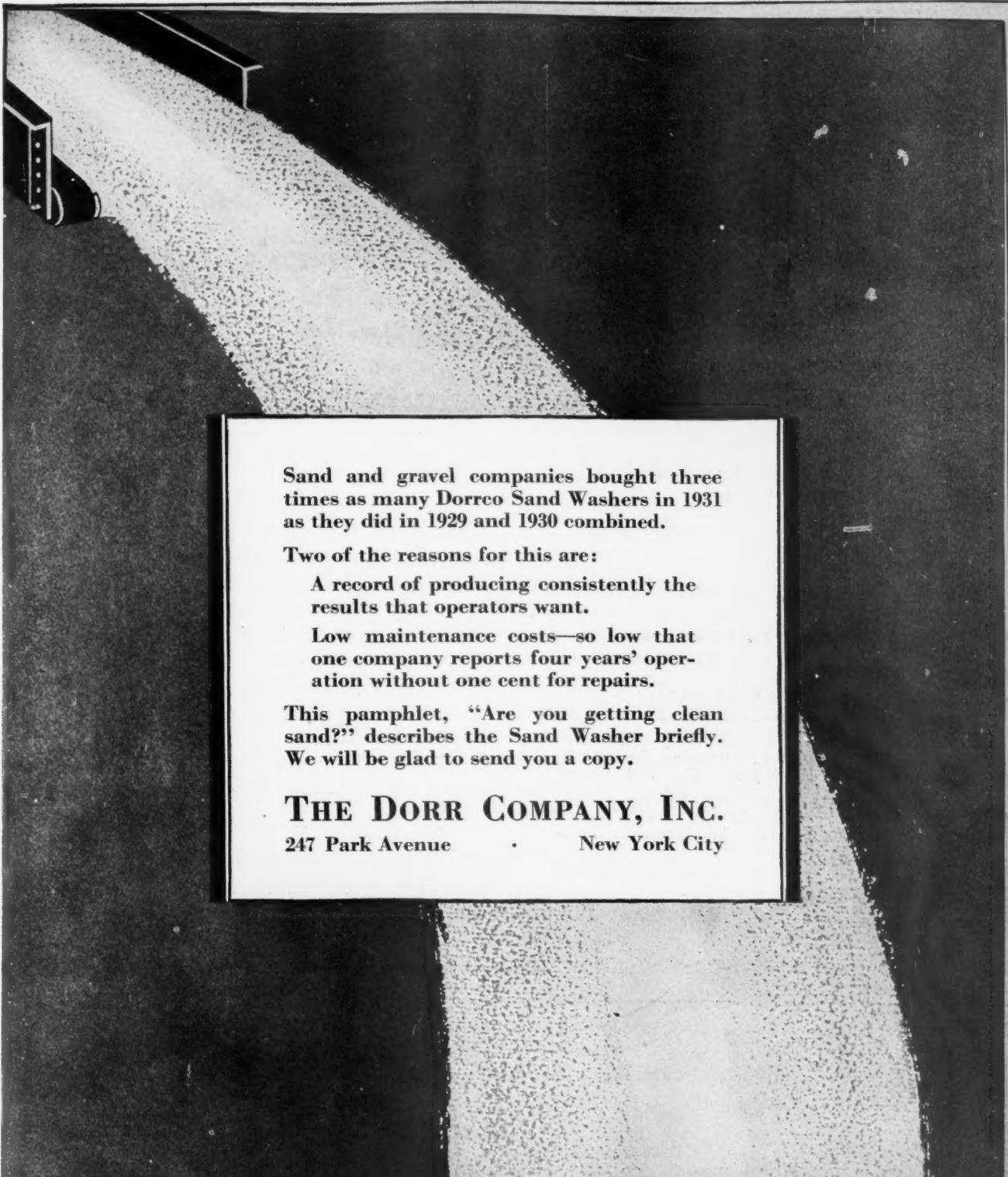
NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention **ROCK PRODUCTS**.

Paint. Bulletin tells of barreled sunlight in various industrial buildings. **U. S. GUTTA PERCHA PAINT CO.**, Providence, R. I.

Car Puller. Leaflet briefly illustrates and describes the "Monitor" car puller. A fully enclosed unit. **STEPHEN-ADAMSON MANUFACTURING CO.**, Aurora, Ill.

Snow Plow. Folder illustrates the "Meyer" snow plow now manufactured by Shunk Manufacturing Co. for use on passenger cars. **SHUNK MANUFACTURING CO.**, Bucyrus, Ohio.

Truck Weighing Device. Bulletin describes the Drive-On Loadometer for measuring the loaded weight of trucks, trailers, busses and tractors. **BLACK AND DECKER MANUFACTURING CO.**, Towson, Md.



Sand and gravel companies bought three times as many Dorco Sand Washers in 1931 as they did in 1929 and 1930 combined.

Two of the reasons for this are:

A record of producing consistently the results that operators want.

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This pamphlet, "Are you getting clean sand?" describes the Sand Washer briefly. We will be glad to send you a copy.

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With which is
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